C-Bus™ Basic Programming
C-Bus™ Products Training Course

Training Guide

1250SM0904R10/09

Retain for future use.

Schneider Electric

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

Danger indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Warning indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION

Caution indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

Caution, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage or improper operation.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. This document is not intended as an instruction manual for untrained persons. No responsibility is assumed by Square D for any consequences arising out of the use of this manual.

Class B FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this device that are not expressly approved by Schneider Electric could void the user's authority to operate this equipment.

Safety Precautions

Carefully read and follow the safety precautions below before attempting to install or maintain electrical equipment.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced by qualified electrical personnel.
- Turn off all electrical power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

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Clipsal Introduction

Introduction to C-Bus

C-Bus History

Clipsal Australia first started from humble beginnings in 1920, with a range of adjustable conduit fittings that 'clips all' sizes of conduit, thus the name Clipsal was born. Years on, Clipsal has become one of the leading producers of electrical products in its field.

As a company and brand, Clipsal has continuously developed and evolved to meet the needs of commercial and domestic requirements. Development in automation products led to the formation of CIS (Clipsal Integrated Systems) in 2000, a business unit of Clipsal Australia specialising in the manufacture of electronic lighting and building automation products. Since then CIS has grown rapidly, gaining widespread acceptance in major commercial and domestic markets.

Through extensive research and design, Clipsal developed the C-Bus Energy Management and Control System back in 1994, and since then C-Bus has become the benchmark of CIS' product range. Initially, C-Bus was designed and manufactured for commercial applications, however due to increasing worldwide interest, C-Bus has been adapted to suit the domestic market with the release of C-Bus DIN Rail Series and other associated products.

With the development of C-Bus for domestic applications, a new generation of products was born including the Scene Master Scene Controller, C-Touch Colour Touch screens, Neo C-Bus wall switches, and Saturn C-Bus wall switches.

When the C-Bus Neo range was first launched in 2002, it immediately became the 'new face' of Clipsal's C-Bus offering. Neo's superb design was one of inspiration, as Clipsal consulted architects and designers for their input, to create a switch that complimented the beautiful home environment. The Saturn Range of switches is also a real "head turner". They are manufactured from handcrafted glass with bevelled edges and apertures cut for its distinctive circular backlit switches.

The year the Neo Range was launched it won the Australian Electrical and Electronic Manufacturer's Association (AEEMA) Award for Excellence in Commercialising Research & Development. In the same year, C-Bus took on the best of European technology to win the 2002 UK Electrical Product Award in the category of Contribution Towards Energy Saving. This was a significant achievement against other established brands. C-Bus really proved its worth over competitor's technology based on proven IP (intellectual property), superior performance, features and customer value.

CIS continue to set new precedents by expanding the C-Bus Range by introducing products such as C-Bus Wireless Technology, Dynamic Labelling Technology, Reflection Series, Saturn Series and Multi-Room Audio. Not only is the C-Bus product range extensive, but it also complies with ISO9001 Accreditation.

In conclusion, CIS are continually striving to meet the demands and requirements of their customers by offering the highest quality energy

control and management products available on the market. CIS believe that by achieving this they will remain an innovative force behind the design and manufacturing of automated electronics.

What Is C-Bus?

The Clipsal C-Bus system is a microprocessor based wiring system to control lighting and other electrical services. Whether ON/OFF control of a lighting circuit or analogue type control such as dimming electronic fluorescent ballasts, C-Bus can be used to control and automate virtually any type of electrical load.

To ensure fast and reliable operation, each device has its own inbuilt microprocessor, which can be individually programmed via PC based software, or via 'Learn Mode' which doesn't require a PC.

C-Bus programming information is held within individual C-Bus units rather than one central point. This means that each C-Bus network maintains a distributed intelligence, ensuring optimum communications speed, redundancy and reliability.

While a computer is unnecessary for normal C-Bus operation, C-Bus PC based control and management software is available and provides additional flexibility to clients requiring this type of control.

Clipsal C-Bus is suitable for a wide range of applications, such as:

- Commercial Lighting Control
- Standalone Room Lighting Control
- Residential Automation

Commercial Lighting Control

In the commercial sector, C-Bus allows the following:

- Fluorescent lighting control for energy cost saving in high-rise buildings
- High-bay control in warehouses for energy cost saving
- Mood lighting in restaurants and retail outlets
- Flexible and integrated control of lighting and Audio Visual equipment in boardrooms
- Architectural lighting controls for hotel foyers, ballrooms, art galleries and museums.

Standalone Room Lighting Control

A common misconception of C-Bus is that it needs to be installed throughout the installation. C-Bus may be installed in standalone situations, for example:

- Mood setting in conference rooms
- Automated processes in home theatres.

Residential Automation

In the residential sector, C-Bus allows the following:

- Integration between audiovisual, lighting control, and other electrical services.

- Integration between security, lighting and other electrical services.
- Comfortable dimming and mood setting options.
- Convenient control via C-Bus wall switches, Touch Screens, time schedules and mood settings.

Why Use C-Bus?

C-Bus provides the installer and end user with the following benefits:

- Energy management
- Flexibility
- Functionality
- Simple wiring.

Energy Management

With the increasing global awareness of energy consumption, energy management is now a critical aspect of all buildings in the residential, industrial and commercial markets.

The installation of a C-Bus system into any building will help to reduce its energy consumption. This will pass on cost savings to the building's occupants and reduce carbon emissions for the environment.

Some ways that C-Bus can be used to reduce energy consumption in a building is to utilise:

- Occupancy Sensors
- Time Scheduling
- Restricting lighting loads to operate below 100%
- Automatic Timers
- Light Level Maintenance
- Automated Blind Control
- Temperature Control.

Flexibility

C-Bus can be installed and programmed to provide the user with ultimate flexibility. C-Bus offers the ability to:

- Reprogram units as often as necessary
- Change the function or relationship of switches and loads, without any need for rewiring
- Control a single load circuit from multiple switches via simple programming
- Control multiple load circuits from a single switch via simple programming.

Functionality

C-Bus offers many elements of functionality to a building which conventional wiring cannot offer. This includes functions such as:

- Automated events triggered via logic or time and date schedules
- Mood settings for loads to be set to predefined levels with fade times
- Infrared or Wireless remote control of C-Bus
- Integration with various third party systems such as Security, Audio Visual, Irrigation etc.

Simple Wiring

Conventional wiring practices allows current (which flows through the load), to also flow through the switch that is controlling the load. This requires heavy conductors to run between the distribution board, the load and switches. These aspects add to wiring complexity that in turn, increases installation time, documentation control and overall system cost. Maintenance and system flexibility also becomes a serious problem.

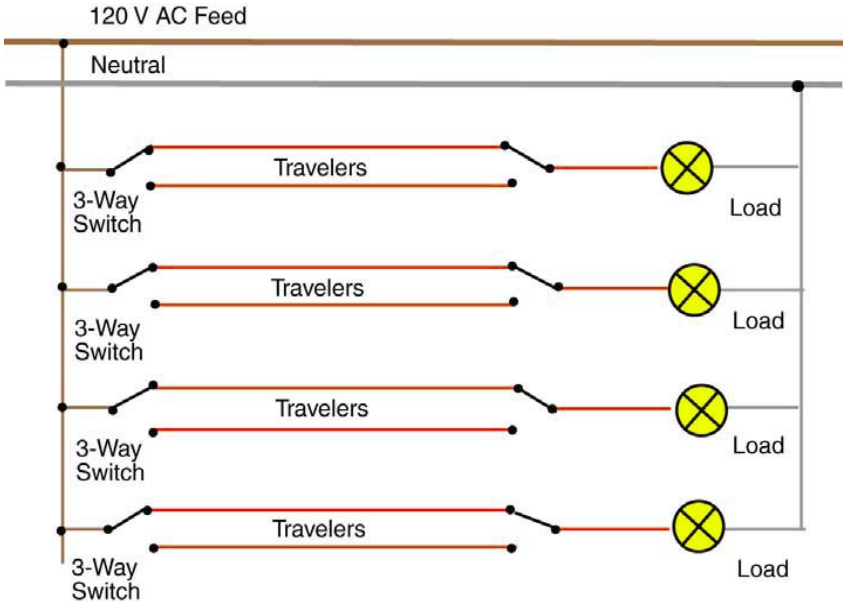


Figure 1 - Conventional wiring for two-way switching

The C-Bus network overcomes these problems. It uses a single Category 5 cable to connect and communicate messages between light switches and load controlling devices. This wiring method also:

- Greatly reduces the number of heavy control wires
- Reduces installation time
- Centralises and terminates all load circuits at a common distribution board
- Additional control units can be added by connecting the unit to any point of the C-Bus Category 5 cable.

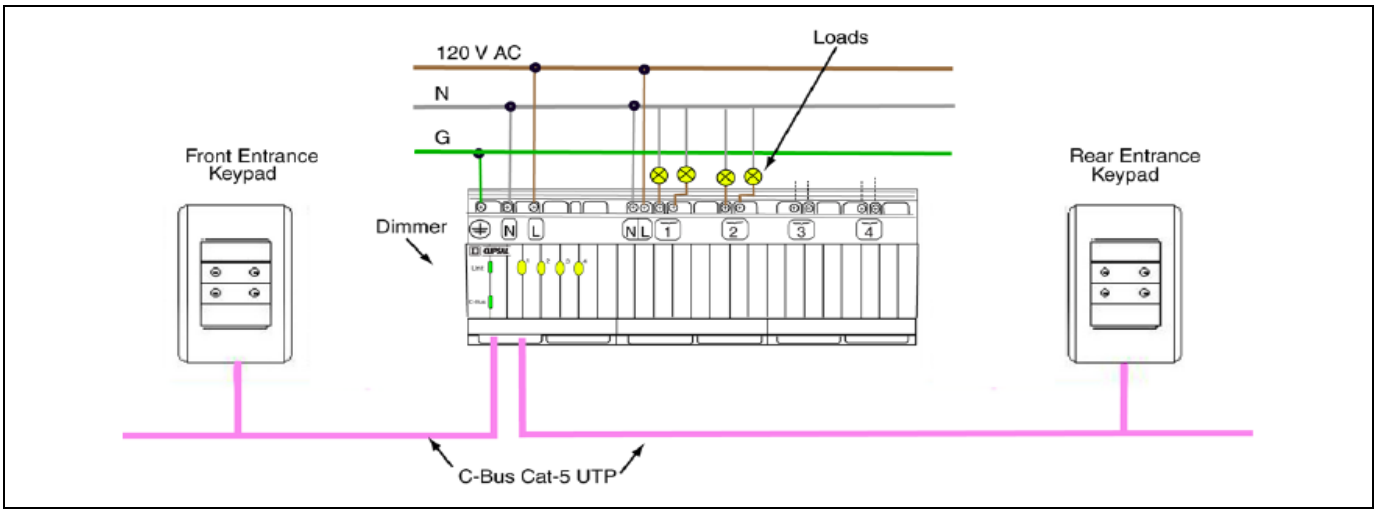


Figure 2 - C-Bus wiring for two-way switching

C-Bus Principles

C-Bus Components

C-Bus networks will usually have a number of different units connected to it. All C-Bus units fall into one of three main categories:

- system support devices
- input units
- output units.

There is also a suite of software packages that are used to program C-Bus, or to add functionality to the project.

System Support Devices

System Support Devices are C-Bus units that provide the fundamental properties for a C-Bus network to operate. These units may provide the ability to generate:

- C-Bus power
- a data synchronisation clock pulse.

System support devices also:

- allow a C-Bus network to be programmed
- offer interconnection between different C-Bus networks
- allow integration between C-Bus and third party systems.

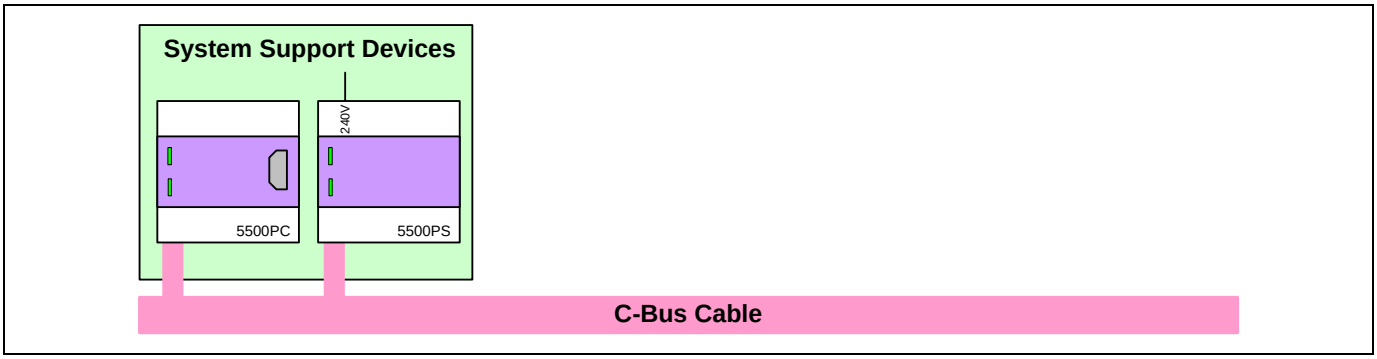


Figure 3 - Connecting system support devices to a C-Bus network

C-Bus Power Supply

A C-Bus Power Supply is a unit that provides C-Bus voltage to the C-Bus network. C-Bus Power Supplies are available in two styles:

- standalone
- onboard.

Standalone C-Bus Power Supplies are independent C-Bus units, whose sole purpose is to provide power to the C-Bus network.

Onboard power supplies are inbuilt into some C-Bus units, such as dimmers and relays. Onboard power supplies provide C-Bus power to the C-Bus network as well as the unit that it is inside of.

All C-Bus power supplies provide 36 VDC to the C-Bus network. All C-Bus units are capable of operating between 15 and 36 VDC. If the C-Bus voltage is at the lower end of the scale, some C-Bus units may behave unexpectedly.

NOTE: It is strongly recommended that all points along the C-Bus network, maintain a C-Bus voltage which is no more than 10 VDC less than the maximum C-Bus voltage on the network (normally found at the distribution board) and not less than 22VDC. This will ensure a stable and robust C-Bus network.

The table below lists the different C-Bus power supplies and the amount of current that they provide to the
C-Bus network.

Type Of C-Bus Power Supply	Output Current
DIN rail stand alone	350 mA
DIN rail onboard	200 mA
Pro Series Dimmer onboard	60 mA
Matrix Switcher	330 mA

Table 1 - C-Bus power supply output currents

PC Interface

A PC Interface is a C-Bus unit that allows you to:

- program C-Bus units using a PC
- control and monitor C-Bus units from a PC
- integrate to third party systems.

It also has the ability to provide a C-Bus network with a:

- C-Bus Clock
- software Selectable network burden.

There are 4 types of C-Bus PC Interfaces that are listed in the table below.

Unit Name	Catalogue Number	PC Connection Method
C-Bus PC Interface	SLC5500PC	RS-232
C-Bus USB PC Interface	SLC5500PCU	USB
C-Bus Network Interface	SLC5500CN	Ethernet
C-Bus Telephone Interface	SLC5100TUA	Modem

Table 2 - Types of PC Interfaces

Figure 4 – USB and Ethernet PC Interfaces

Network Bridges

A C-Bus Network Bridge is a C-Bus unit that is used to connect one C-Bus network to another. The C-Bus Network Bridge allows you to:

- program a remote C-Bus network from the local C-Bus network
- pass messages between C-Bus networks
- filter out unwanted application addresses from passing between C-Bus networks.

It also has the ability to provide:

- electrical isolation between C-Bus networks
- a C-Bus clock to both C-Bus networks
- a software selectable network burden to both C-Bus networks.

A C-Bus Network Bridge will not pass:

- a C-Bus Clock between C-Bus networks
- C-Bus Voltage between C-Bus networks
- a network burden between C-Bus networks
- a multipoint to multipoint interrogation (MMI) between C-Bus networks.

Input Units

Input units are C-Bus units, which respond to a type of stimuli. There are a number of different stimuli that an input unit will respond to, some of these may be:

- The user pressing a wall switch button.
- A motion sensor detecting movement.
- Ambient light conditions reaching a particular light level.
- An infrared remote control sending commands to a C-Bus IR Receiver.
- A time based schedule.
- A dry contact opening or closing.

As a result of the input unit responding to stimulation, a C-Bus message is generated by the input unit and transmitted onto the C-Bus network.

C-Bus input units also respond differently depending on the users interaction with it. This is dependant on:

- how the input unit is programmed
- how long the user is interacting with the input unit.

An example of this is if a wall switch button is programmed as a dimmer. If the user presses the button quickly, it will turn the load on or off. However, if the user presses and holds down the button, it will dim the load up or down.

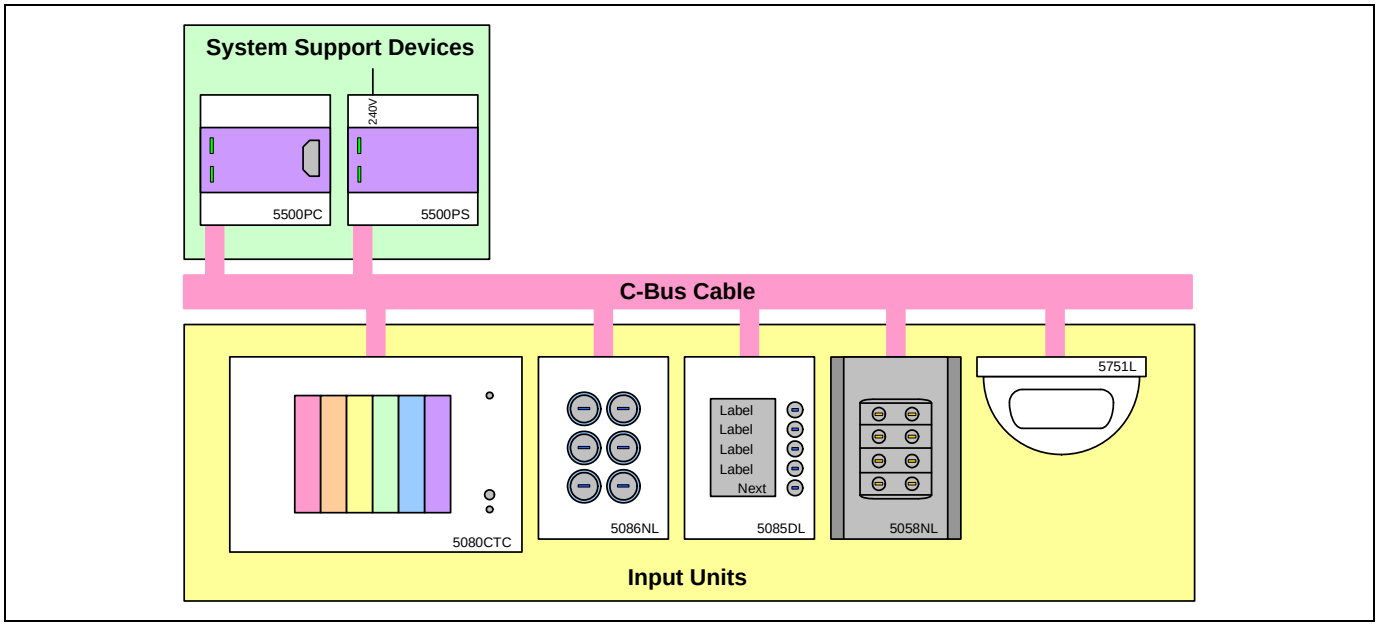


Figure 5 - Connecting C-Bus input units to a C-Bus network

C-Bus Wall Switches

There are a number of different styles of C-Bus wall switches, which fall into two categories:

- Standard Core
- Neo Pro Core.

A Standard Core C-Bus wall switch allows basic C-Bus control such as On/Off, Dimmer, Timer, Preset, Bell Press, etc.

A Neo Core C-Bus wall switch provides the same functionality as the Standard Core, but it also provides the following features:

- scenes
- dual applications
- corridor linking
- Enable/Disable keys
- night light and indicator control.

C-Bus wall switches are available in the following styles.

Wall Switch Style	Button Configurations
2000 Series	1, 2 and 4 buttons
Neo	2, 4 and 8 buttons
Saturn	2, 4 and 6 buttons
DLT	8 buttons/keys (4 on each of 2 pages)

Table 3 - C-Bus wall switch styles and button configurations

The Reflection style of wall switch uses a custom wall box to mount flush on the wall. A standard wall box will not allow the faceplate to be positioned flush against the wall.

Figure 6 - A Neo and Saturn input switch

C-Bus Sensors

There are a number of different types of sensors that can connect to a C-Bus network. Each C-Bus Sensor has a different functionality and responds to different stimuli. The C-Bus product range includes the sensors in the table below.

Sensor Name	Catalogue Number	Detection Via
C-Bus Temperature Sensor	SLC5031TS	Temperature
C-Bus Infrared Receiver	SLC5034NIRL	Infrared
C-Bus Light Level Sensor	SLC5031PE	Lux
C-Bus PIR Sensor (indoor)	SLC5751L (90°), SLC5753L (360°)	Movement
C-Bus PIR Sensor (outdoor)	SLC5750WPL	Movement
C-Bus Multi Sensor	SLC5753PEIRL	Movement, Lux, infrared

Table 4 - Types of C-Bus sensors

Figure 7 - The 90° indoor PIR and Multi Sensor

Touch Screens and Controllers

C-Bus also has different touch screens and controllers that can be connected to a C-Bus network. These units will provide greater flexibility and intelligence. They include:

- C-Touch Black & White Touch Screen (with or without logic engine)
- C-Touch Colour Touch Screen
- Pascal Automation Controller
- C-Bus Home Gateway.

NOTE: All touch screens and Pascal Automation Controllers are programmed via the PICED software.

Touch screens and controllers offer the following features:

- scenes
- time based scheduling
- real-time parameter changing
- logic
- sending and receiving serial strings
- access control
- control via infrared

Consult the PICED Help Files for more information.

NOTE: These features may change depending on the C-Bus Catalogue Number of the touch screen or Pascal Automation Controller.

Figure 8 - C-Touch Colour Touch Screen

Miscellaneous Inputs

There are a number of other C-Bus input units that connect to a C-Bus network, which will allow the control of a group address. These C-Bus units include:

Unit Name	Catalogue Number	Controlled Via
C-Bus Auxiliary Input	SLCL5504AUX	Dry contact
C-Bus Bus Coupler	SLC5014BCL	Dry contact
General Input	SLC5504GI	Voltage, current, resistance

Table 5 - Other types of C-Bus input units

Figure 9 - C-Bus Bus Coupler and Auxiliary Input units

Output Units

Output units are C-Bus units which are used to control electrical loads. Some loads that can be controlled by output units are:

- lighting circuits
- towel rails
- curtain control motors
- DSI electronic ballasts
- infrared control.

Output units respond to the C-Bus messages that are generated by C-Bus input units.

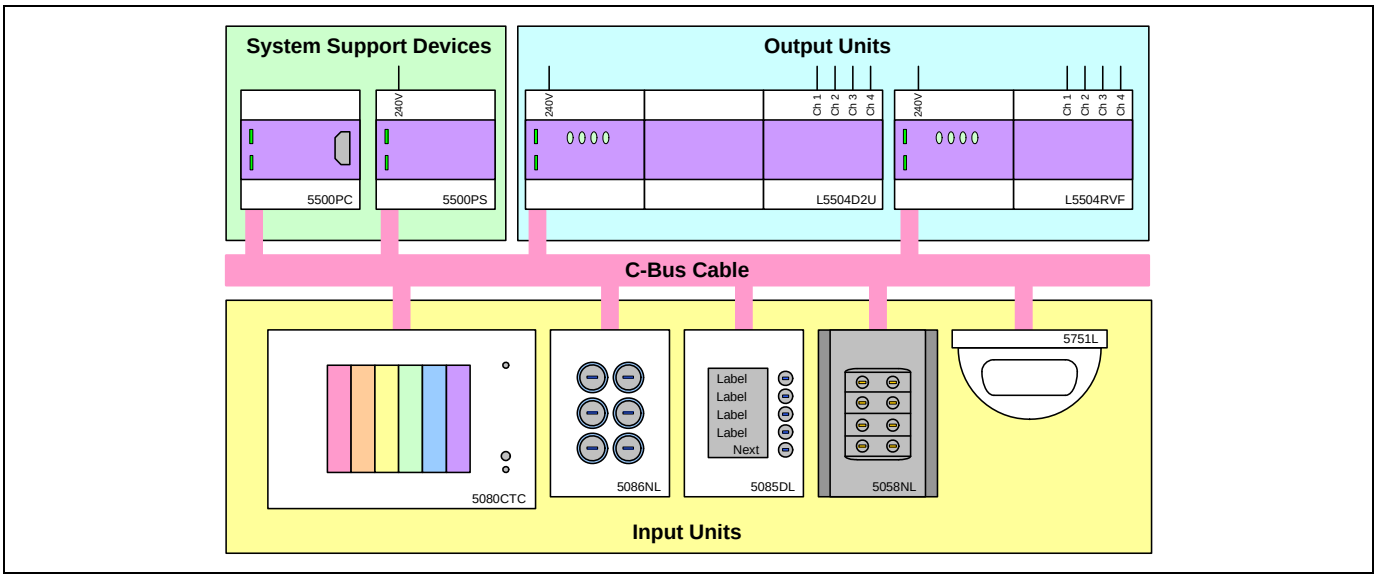


Figure 10 - Connecting C-Bus output units to a C-Bus network

C-Bus Relays

C-Bus relay output units are available in a number of different DIN rail enclosures for different purposes. All DIN rail relays are voltage free. This allows the relays to be used in a range of different applications such as lighting and fan control.

All DIN rail relay units (excluding the C-Bus Shutter Relay) are available with or without an onboard 200 mA
C-Bus power supply. They can also provide a C-Bus clock and have a software selectable network burden.

Unit Type	Relay Channels	Current Rating	Modules Wide
DIN rail relay	4, 12	10 Amp	8 and 12
Change over relay	4	10 Amp	8

Table 6 - Types of DIN rail relays

NOTE: The change over relay consists of a Normally Open, Normally Closed and a Common relay configuration.

There is also a 1 and 2 channel relay that are designed to be mounted at the load, rather than at the distribution board. Both relays are rated at 10 Amps, however:

- The 1 channel relay is not voltage free (it switches the mains supply). It also has the ability to provide a 0 to 10 V analogue signal to dim analogue 0 to 10 V ballasts.
- The 2 channel relay is voltage free.

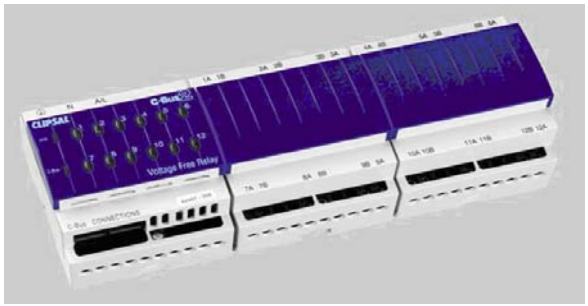


Figure 11 - C-Bus 2 channel and 12 channel DIN rail relays

C-Bus Dimmers

C-Bus dimmer output units are available in 3 styles:

- DIN rail dimmers
- professional dimmers

All C-Bus dimmers can provide a C-Bus clock and a software selectable network burden to the C-Bus network. Also only DIN rail dimmers are available with or without an onboard 200 mA C-Bus power supply.

Unit Name	Channels	Dimming Method	Current Rating
DIN rail dimmer	8	Leading edge	2 Amp
DIN rail dimmer	4	Leading edge	4 Amps

Table 7 - Types of DIN rail dimmers

CAUTION

CONNECTING DIMMERS TO DIFFERENT PHASES WILL RESULT IN DIMMERS NOT DIMMING

Do not connect the dimmer to two different phases. All mains wiring for a single dimmer must be on the same phase.

Failure to follow these instructions will result in improper operation.

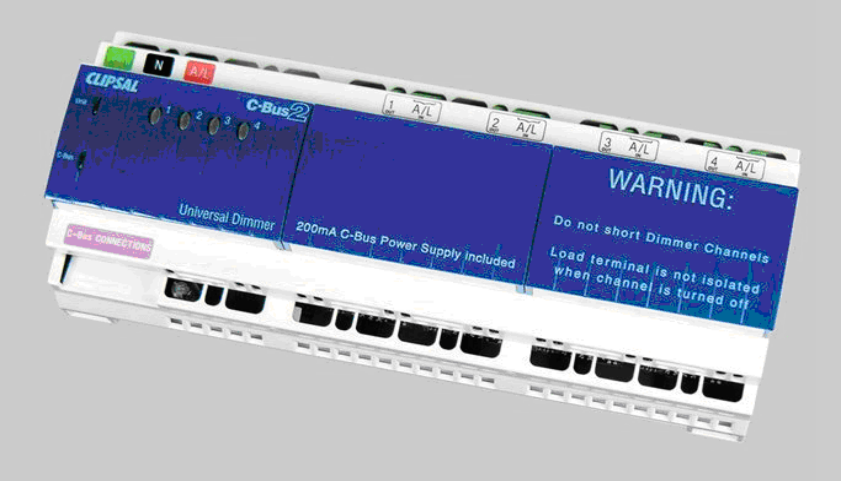


Figure 12 - C-Bus DIN Rail Universal Dimmer and a 12 channel C-Bus Architectural Dimmer

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all electrical power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in equipment damage.

CAUTION

SHORTING DIMMER OUTPUTS CAN RESULT IN EQUIPMENT DAMAGE

- Turn off power before servicing this unit or a connected load.
- Do not short the dimmer outputs.

Failure to follow these instructions will result in equipment damage.

Do not short dimmer channels. The load terminals are not isolated when the channel is turned off. This means that 120 V is always present at each channel, even when it is in the off state.

Maximum Load Calculations

To calculate the maximum load/number of loads that can be wired to a channel of an output unit, we need to identify:

- four parameters for maximum load on a dimmer
- two parameters for maximum load on a relay.

The parameters needed to calculate the maximum load on a dimmer are the:

- VA of the electronic transformer
- input capacitance of the electronic transformer
- maximum VA of the C-Bus dimmer channel
- maximum capacitance of the C-Bus dimmer channel.

The parameters needed to calculate the maximum load on a relay are the:

- VA of the electronic transformer
- maximum VA of the C-Bus relay channel

NOTE: To find the VA and input capacitance of electronic transformers, contact the transformer's manufacturer.

The maximum VA and capacitance of C-Bus output units are identified in the table below.

	Amps Per Channel	Max Capacitance Per Channel	Max VA Per Channel
DIN rail dimmer	2 4	300 nF 300 nF	480 960
Professional dimmer	10 16 20	N/A	2400 3840 4800
DIN rail relay	10 20	N/A	2400 4800

Table 8 - C-Bus output unit parameters

To calculate the amount of loads that can be wired to a channel of a C-Bus output unit, please follow the steps in the table below.

NOTE: To calculate the number of electronic transformers that can be wired to a channel on a DIN rail relay or a universal, professional or architectural dimmer, only calculate Step 1.

Step 1	• Value A = (Maximum VA per channel) / (VA of the load) • Round down Value A.
Step 2	• Value B = (Capacitance per channel) / (Input capacitance of the load) • Round down Value B.
Step 3	Compare Value A and Value B. The lower of the two is how many electronic transformers can be wired to a single C-Bus dimming channel.

Table 9 - Calculating how many electronic transformers can be used

The following is an example of how to calculate the number of electronic transformers that can be used on a single C-Bus dimmer channel.

Assume you have an electronic transformer that you want to wire to a C-Bus 8 Channel DIN Rail Dimmer. The brand 'XYZ electronic transformer' has the following properties:

- a VA rating of 55 VA
- an input capacitance of 100 nF.

Step 1	Value A = 240 VA / 55 VA = 4.36 Rounded Down = 4
Step 2	Value B = 300 nF / 100 nF = 3 Rounded Down = 3
Step 3	Value B is less than Value A, therefore only 3 "XYZ" electronic transformers can be wired to a single channel of a C-Bus 8 Channel DIN Rail Dimmer.

Table 10 - Example calculation

Fluorescent Dimming

C-Bus is able to dim fluorescent fittings using a C-Bus:

- Analogue Output
- DSI Gateway
- DALI Gateway.

The C-Bus Analogue Output is a 4 channel 0 to 10 V device. It is capable of controlling 0-10 V electronic ballasts by sinking 8 mA and sourcing 2.5 mA. The number of 0-10 V electronic ballasts that can be placed onto a single analogue channel depends on the characteristics of the ballast.

NOTE: When the analogue output channel is off, the fluorescent fittings on that channel appear to be off. However, 0-10 V electronic ballasts don't turn off even though the fitting appears to be off. Therefore a C-Bus relay is required to switch the mains voltage to the electronic ballast.

A C-Bus DSI Gateway is an 8 channel device that is capable of controlling DSI electronic ballasts. Each channel of the gateway can control up to approximately 100 DSI electronic ballasts.

A C-Bus DALI Gateway can communicate to:

- 2 DALI networks
- 64 DALI ballasts on a single DALI network
- 16 DALI groups on a single DALI network.

C-Bus group addresses are mapped to a DALI ballast or group to provide control and dimming of a fluorescent light fitting.

NOTE: Clipsal Integrated Systems will not support the design, commissioning or fault finding of a DALI network. Please contact the manufacturer of the DALI equipment for further information.

Figure 13 - C-Bus DSI and DALI Gateways

IR Transmitter

The C-Bus Infrared Transmitter is a 2 channel device that is commonly used to control audiovisual equipment such as televisions, amplifiers and DVD players. Each channel will have an Infrared Emitter Lead which is connected from the ¼ inch jack, to the infrared receiver on the device that you want to control.

The C-Bus Infrared Transmitter is programmed via the CIRCA software (not C-Bus Toolkit), and requires a High Speed Programming Cable (5100HSCU) to download the mapping of infrared commands to C-Bus group addresses.

Figure 14 - The C-Bus Infrared Transmitter

Software

There are a number of different software packages used for the programming, monitoring and controlling C-Bus. The table below lists the name and purpose of the more commonly used C-Bus software packages.

Software Name	Software Purpose
C-Bus Toolkit	Used to program and commission most C-Bus units.
PICED	PICED is an acronym for Programming Interface for C-Bus Embedded Devices. Used to program C-Bus Touch Screens, Pascal Automation Controller and the Premise Gateway.
MARPA	MARPA is an acronym for Multi Room Audio Rapid Programming Application. Used to program the Multi Room Audio Matrix Switcher.
TICA	TICA is an acronym for Telephone Interface Commissioning Application. Used to program the C-Bus Telephone Interface.
CIRCA	CIRCA is an acronym for C-Bus Infrared Commissioning Application. Used to program the C-Bus Infrared Transmitter unit.
IR Reader	Used to build custom infrared libraries to be used with the CIRCA software and the C-Bus Infrared Transmitter.
HomeGate	Used for centralised PC control and monitoring of a C-Bus network. Designed for the residential market.
Schedule Plus	Used for centralised PC control and monitoring of a C-Bus network. Designed for the commercial market.
Diagnostic Utility	Used to diagnose and test the integrity of C-Bus networks.

Table 11 - C-Bus software list

C-Bus Network Specifications

There are a number of different factors that affect C-Bus networks. The following chapter will address the various network specifications of a C-Bus network. These specifications need to be met to ensure reliable C-Bus operation.

C-Bus Cable

There are a number of different factors to adhere to when using Cat-5 cable in a C-Bus installation. This section of the manual will identify them.

Cable Type

The C-Bus data cable is a colour coded 4 pair Category 5 UTP data cable. The cable has an outer sheath that is a different colour, which makes it easy to distinguish from other voice and data cables in the installation. The inner cable consists of four unshielded twisted pairs (UTP) providing:

- A high data rate capability
- Immunity to induced noise from external sources
- Superior crosstalk performance
- A known impedance.

The C-Bus Data Cable is recommended for use in all C-Bus installations, especially projects where large cable runs are used on single C-Bus networks.

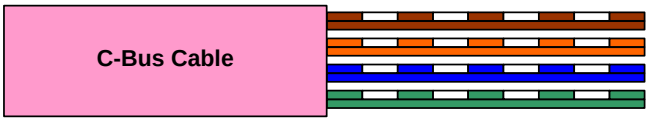


Figure 15 - C-Bus data cable

NOTE: When any C-Bus cable needs to be run underground, it is strongly recommended to use a gel filled Category 5 UTP cable inside of suitable conduit. Consult your local wiring standards for more details.

C-Bus Cable Pairs

C-Bus uses the following Category 5 cable pairs:

Data Pair	Function for C-Bus
Orange + Blue	C-Bus Positive voltage
Orange/White + Blue/White	C-Bus Negative voltage
Green + Green/White	Remote Override On
Brown + Brown/White	Remote Override Off

Table 12 - C-Bus Category 5 UTP cable pairs

Two conductors are used for each positive and negative C-Bus voltage connection. This allows:

- The extra copper provided by the second conductor to reduce voltage drop.
- The extra copper provided by the second conductor to allow the maximum current rating of the C-Bus network to be achieved.

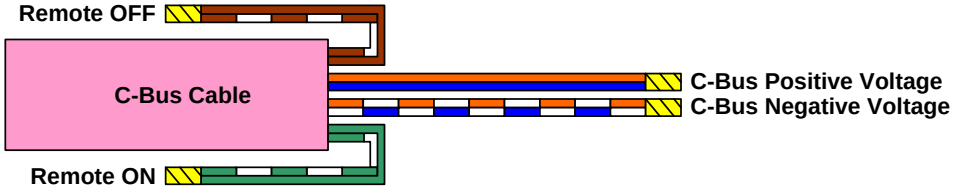


Figure 16 - C-Bus cable pairs

For a manual override control of C-Bus, the Remote Override pairs may be used to send a high priority message to C-Bus. This will lock all of the channels of any output unit (with all four pairs connected) on or off.

The Remote Overrides operate as follows:

- To force a Remote ON, the C-Bus Remote ON pair needs to be shorted to the C-Bus Negative pair
- To force a Remote OFF, the C-Bus Remote OFF pair needs to be shorted to the C-Bus Negative pair.

NOTE: If both the Remote ON and Remote OFF pairs are shorted to the C-Bus Negative Voltage pair, the Remote OFF will take priority.

It is critical that the pairs used for the C-Bus positive and negative voltages are not the natural twisted pairs. Failure to terminate the cable as specified may result in:

- a short circuit on the C-Bus cable
- all channels on Output units being locked on or off due to the Remote Overrides.

Cable Current

Each conductor in the C-Bus cable is capable of carrying 1 Amp of current. As the conductors are doubled up for C-Bus Positive and Negative, this effectively doubles the current carrying capacity of the C-Bus cable. This means that the Category 5 cable is capable of carrying 2 Amps of C-Bus current.

Cable Terminations

The C-Bus cable is commonly terminated three ways:

- by twisting the bare copper ends of the conductors together
- by crimping them in an RJ45 plug (in accordance with the 568A wiring standard)
- by screwing down the cable into the terminals of a terminal block (on selected C-Bus units).

For secure terminations, a bootlace crimp may also be used to terminate C-Bus cables.

When terminating C-Bus cable conductors by twisting wires together, ensure the bare copper of both wires are securely twisted together. Also check that the:

- conductors are not over twisted (try to keep it to about 5 twists)
- copper wires have not been nicked (to reduce potential cable breaks)
- copper wires are not soldered together (cold creep might occur with soldered wires)
- copper wires are not frayed
- stripped conductor length is kept to a practical minimum
- insulation is not damaged.

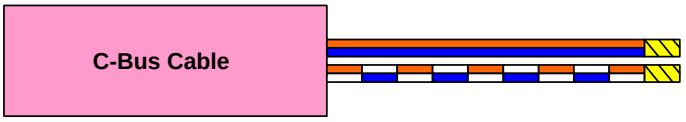
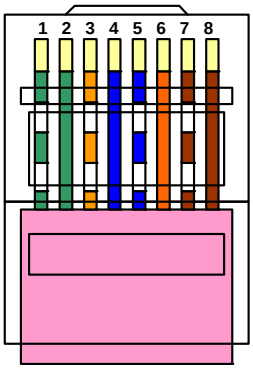


Figure 17 - Terminating C-Bus pairs by twisting the cable

When terminating the C-Bus cable with an RJ45 plug, ensure that the RJ45 has been wired with the correct pin out.

Pin	Wire Function	Wire Colour
1	Remote Override ON	Green & White
2	Remote Override ON	Green
3	C-Bus Negative (-)	Orange & White
4	C-Bus Positive (+)	Blue
5	C-Bus Negative (-)	Blue & White
6	C-Bus Positive (+)	Orange
7	Remote Override OFF	Brown & White
8	Remote Override OFF	Brown



RJ45 with clip facing down

Table 13 - C-Bus RJ45 pinouts

Cable Length

The maximum amount of C-Bus cable that can be installed into a single C-Bus network is 1km. Exceeding this maximum cable length can:

- Distort and corrupt C-Bus messages
- Cause excessive voltage drop across the C-Bus cable.

As a rule of thumb, try not to use more than 3 boxes of Cat-5, Cat-5E, or Cat-6. Each box contains
1000 feet of cable; therefore 3 boxes of Cat-5 will ensure you have used a maximum of 3000 feet.

Cable Topologies

C-Bus cable is installed with three commonly used topologies:

- daisy chain
- star
- combination

Creating a closed loop C-Bus cable topology (when a C-Bus cable loops back to itself) will cause the C-Bus network to operate unreliably and shall not be used. A Daisy Chain Topology refers to the method of interconnecting C-Bus units along a single run of C-Bus cable as shown below.

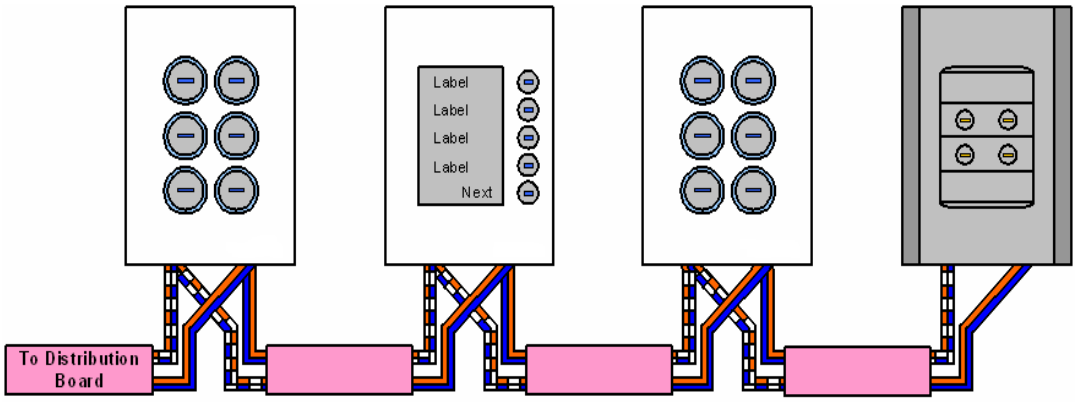


Figure 18 - Daisy chain cable topology

A Star Topology refers to the method of interconnecting C-Bus units on a number of C-Bus branches as shown below.

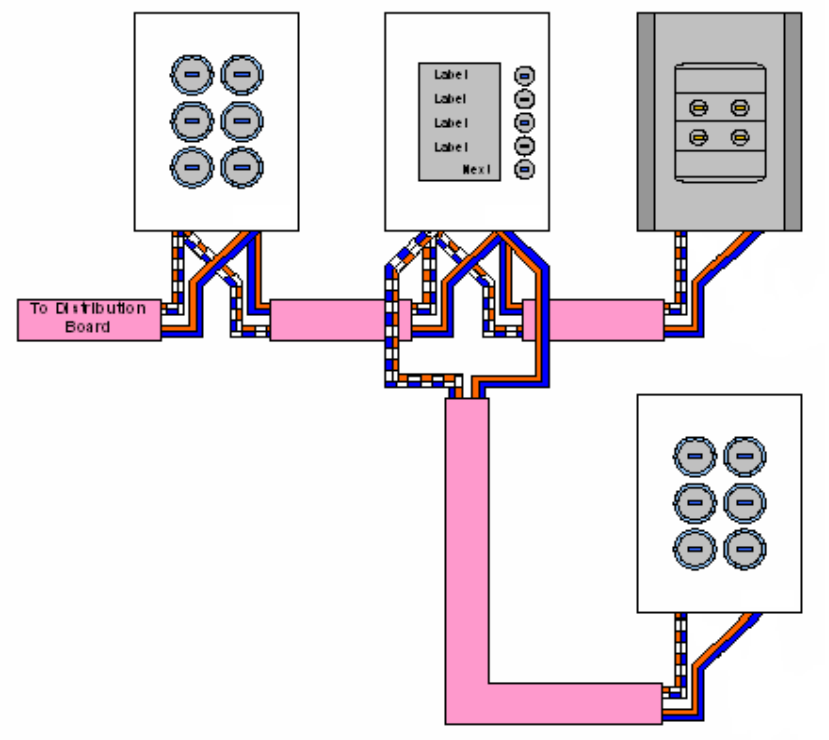


Figure 19 - Star cable topology

A Combination Cable Topology refers to the method of interconnecting C-Bus units which combines the wiring principles of Daisy Chain and Star Cable Topologies as shown below.

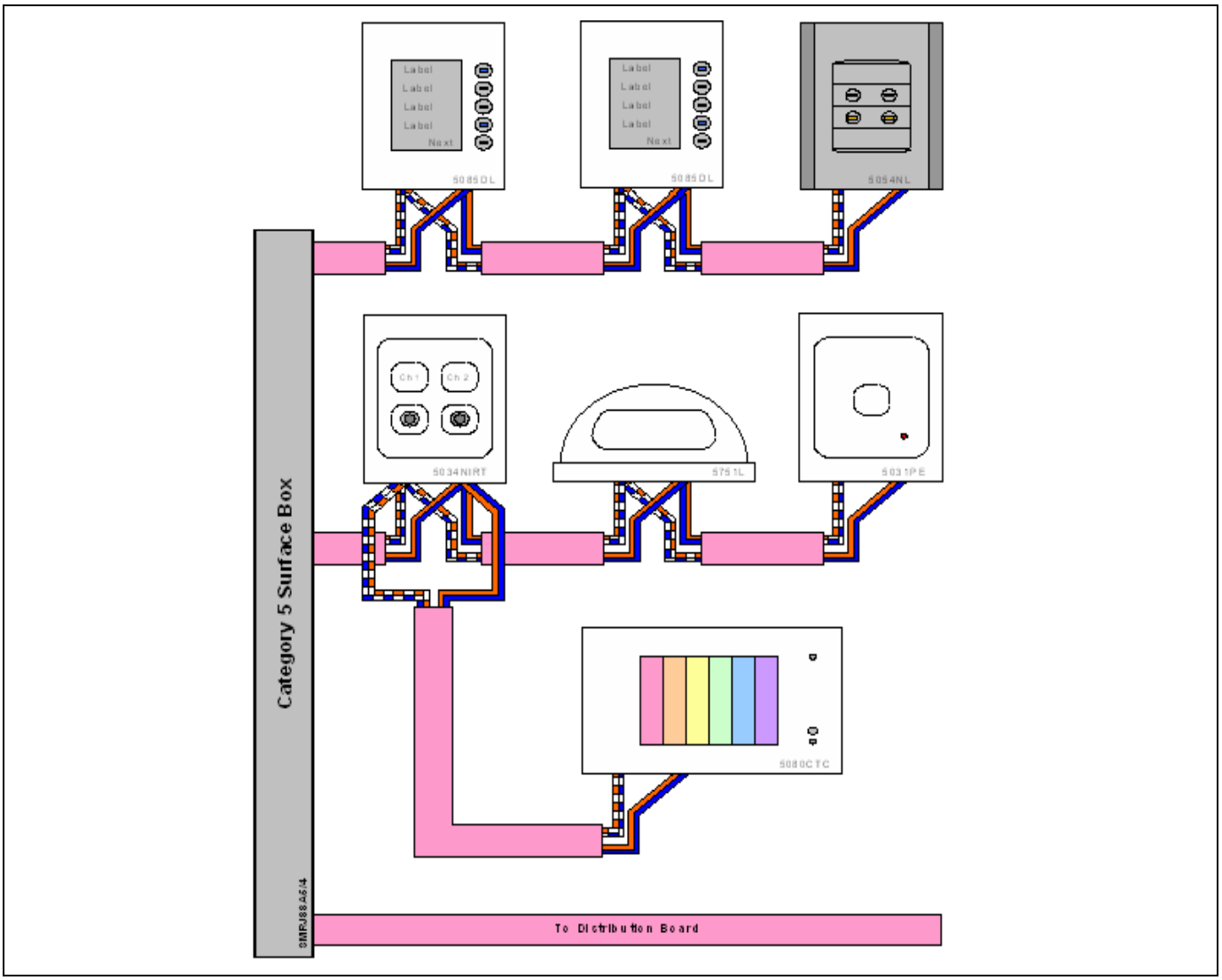


Figure 20 - Combination cable topology

C-Bus Units

There are three critical things to consider with regards to C-Bus units, they are:

- Maximum Number Of Units
- Maximum Number Of Particular Unit Types
- C-Bus Unit Positioning.

Maximum Number Of Units

The maximum number of C-Bus units that can be installed onto a single C-Bus network is 100. However this number may decrease depending on:

- The types of units connected to the C-Bus network
- The current draw of all the C-Bus units on the network.

Maximum Number Of Particular Unit Types

Some C-Bus units have a limitation whereby there cannot be more than a certain number installed onto a single network. Some of the units that have this limitation are listed in the table below. This is a limitation of the specific C-Bus units.

C-Bus Unit Type	Maximum Number Of Units
DLT Switches	50
Saturn Switches	50
Infrared Transmitter	50

Table 14 - Maximum number of unit types on a C-Bus network

NOTE: See the product's Installation Instructions for further details.

C-Bus Unit Positioning

When installing C-Bus output units and System Support Devices, the following points should be considered:

- Is there appropriately located to allow access to the units and limit tampering?
- Is the area well ventilated?
- Is audible noise a problem (eg relays clicking, dimmers humming)?
- Is the unit positioned in areas of appropriate temperature and humidity?
- Is there anything that may cause electrical interference on C-Bus?
- Are IR Transmitters positioned near the equipment that they are controlling?
- Are all DIN Rail output units mounted horizontally?

When installing C-Bus input units, the following questions should be considered:

- Will the C-Bus unit be exposed to any unwanted moisture or humidity?

- Will the brightness of indicators draw unwanted attention?
- Are input units positioned to obtain optimum usability, detection and visibility?
- Can multiple Infrared Receiving devices inadvertently respond to the same command?

C-Bus Voltage

All C-Bus Power Supplies provide 34 VDC to the C-Bus network. All C-Bus units are capable of operating between 15 VDC and 34 VDC. If the C-Bus voltage is at the lower end of the scale, some C-Bus units may behave unexpectedly.

NOTE: It is strongly recommended that all points along the C-Bus network, maintain a C-Bus voltage which is no more than 10 VDC less than the maximum C-Bus Voltage on the network (normally found at the distribution board). In all cases, try to ensure the C-Bus voltage is above 22 VDC. This will help to ensure a stable and robust C-Bus network.

Power Supply Types

C-Bus Power Supplies are available as:

- standalone power supplies
- onboard power supplies.

Standalone C-Bus Power Supplies are independent C-Bus units whose sole purpose is to provide power to the C-Bus network.

Onboard C-Bus power supplies are inbuilt into some C-Bus output units, such as dimmers, relays and Matrix Switchers. Onboard Power Supplies provide C-Bus power to the C-Bus network as well as to the unit that houses it.

NOTE: Onboard C-Bus power supplies have a lower current rating than the standalone C-Bus Power Supplies.

CAUTION

IMPROPER NETWORK PERFORMANCE WHEN USING THIRD-PARTY POWER SUPPLIES

Do not use third-party power supplies to power C-Bus networks. Other power supplies have different impedances.

Failure to follow these instructions will result in improper network performance.

Power Supply Placement

When installing C-Bus Power Supplies, it is best not to install all the C-Bus Power Supplies at the end of a network, as there will be significant voltage drop at the other end of the network.

The following figures shows the C-Bus network voltage, where the C-Bus network consists of:

- A Single C-Bus onboard power supply at the end of a network
- 1 km of C-Bus cable
- 10 C-Bus input units which each draw 18 mA, evenly spaced along the cable.

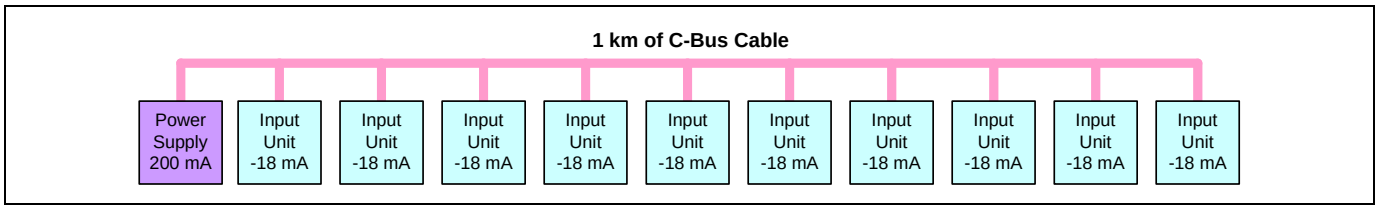


Figure 21 - C-Bus Power Supply at one end of a C-Bus network

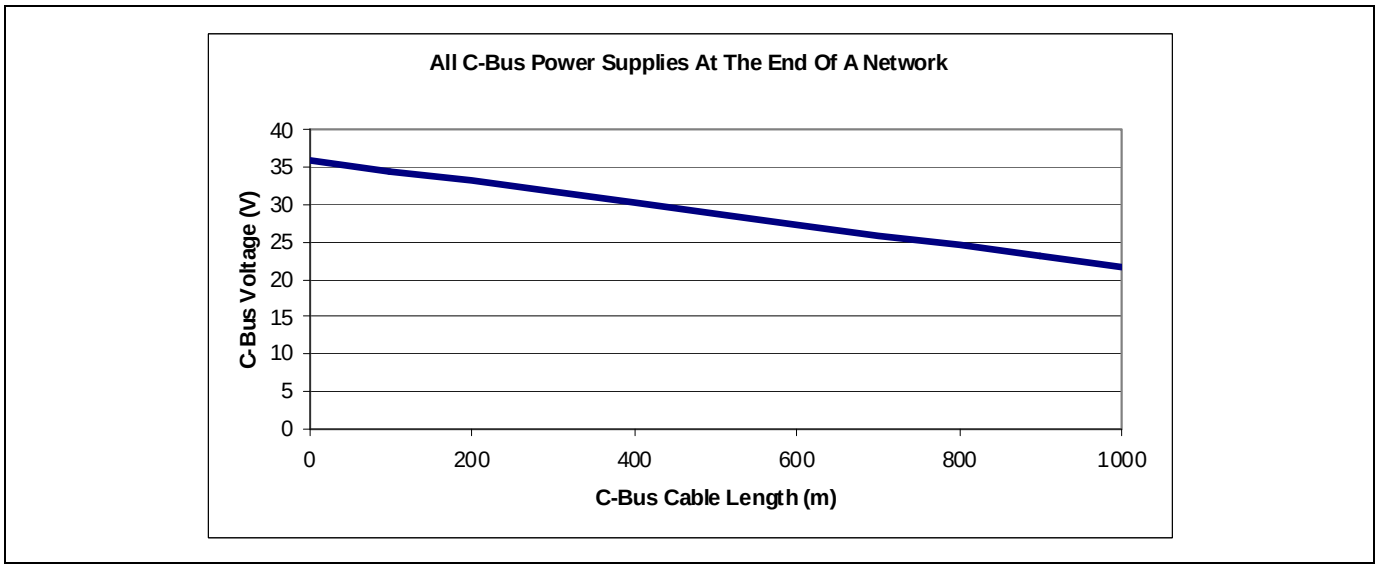


Figure 22 - Voltage drop when power supplies are installed at the end of the C-Bus network

On a network with conditions as specified above, you will note that there will be an estimated Voltage drop of approximately 14.4 VDC.

The preferred C-Bus Power Supply installation method is to install the power supplies at the centre of the
C-Bus network. This can easily be achieved by using Star or Combination cable topologies. This will reduce the amount of voltage drop along the C-Bus cable.

The following figures show the C-Bus network voltage, where the C-Bus network consists of:

- A Single C-Bus onboard power supply at the centre of a network
- 1 km of C-Bus cable
- 10 C-Bus input units which each draw 18 mA, evenly spaced along the cable.

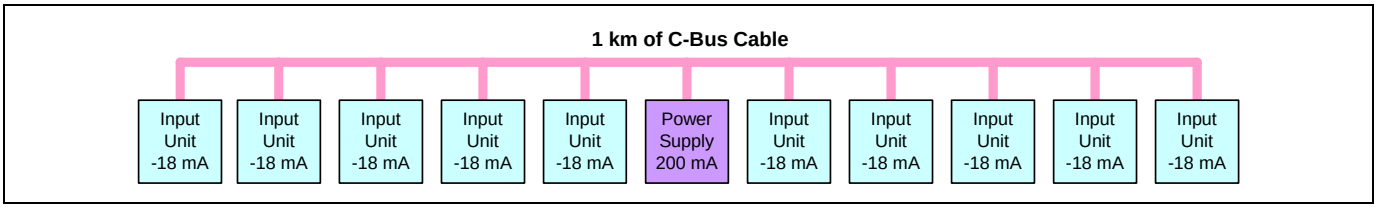


Figure 23 - C-Bus Power Supply at the centre of a C-Bus netowork

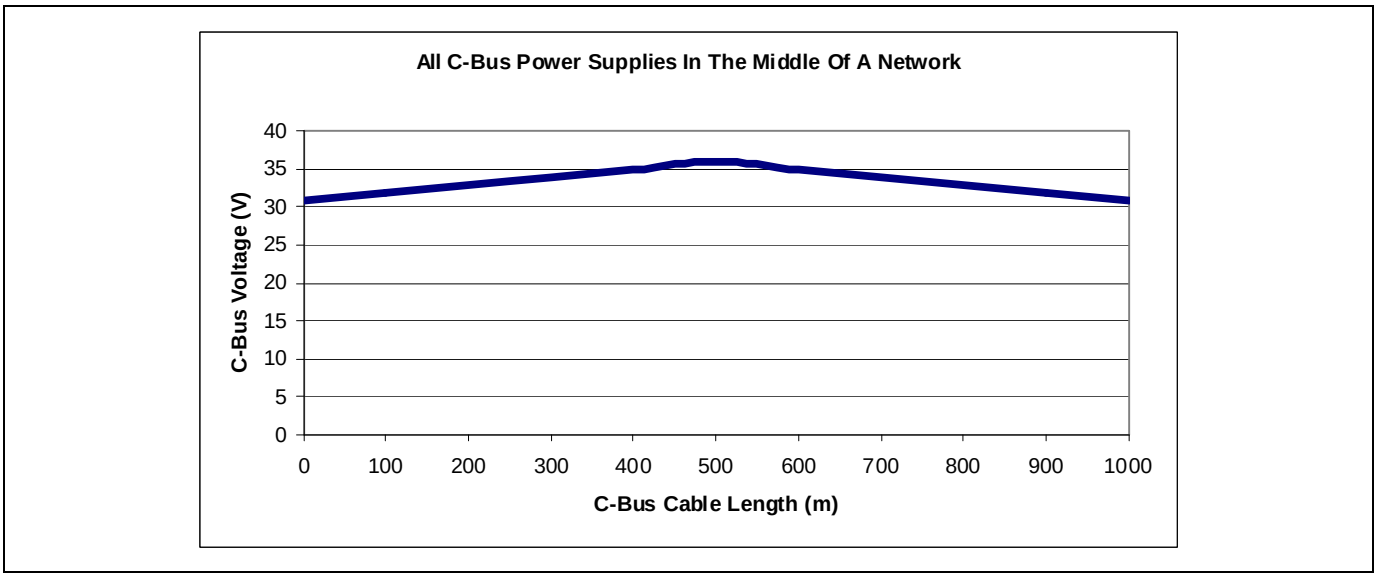


Figure 24 - Voltage drop when power supplies are installed in the middle of a C-Bus network

On a network with conditions as specified above, you will note that there will be an estimated Voltage drop of approximately 5.71 VDC.

The recommended method of installing C-Bus Power Supplies is to evenly distribute the power supplies throughout the network. This will ensure that there is minimal voltage drop, thus guaranteeing an optimum C-Bus operating voltage.

The following figures shows the C-Bus network voltage, where the C-Bus network consists of:

- Two C-Bus onboard power supplies at each end of the network
- 1 km of C-Bus cable
- 10 C-Bus input units which each draw 18 mA, evenly spaced along the cable.

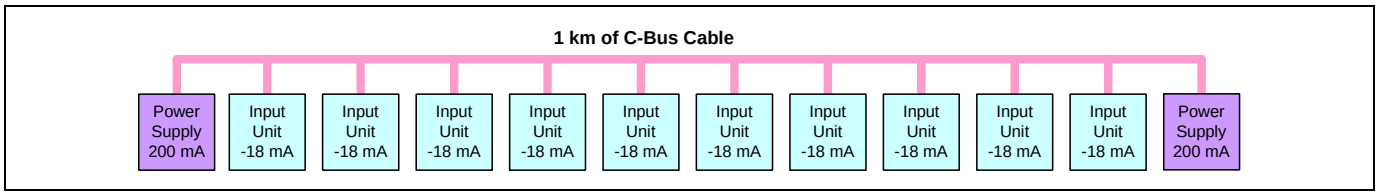


Figure 25 - A C-Bus Power Supply at each end of a C-Bus network

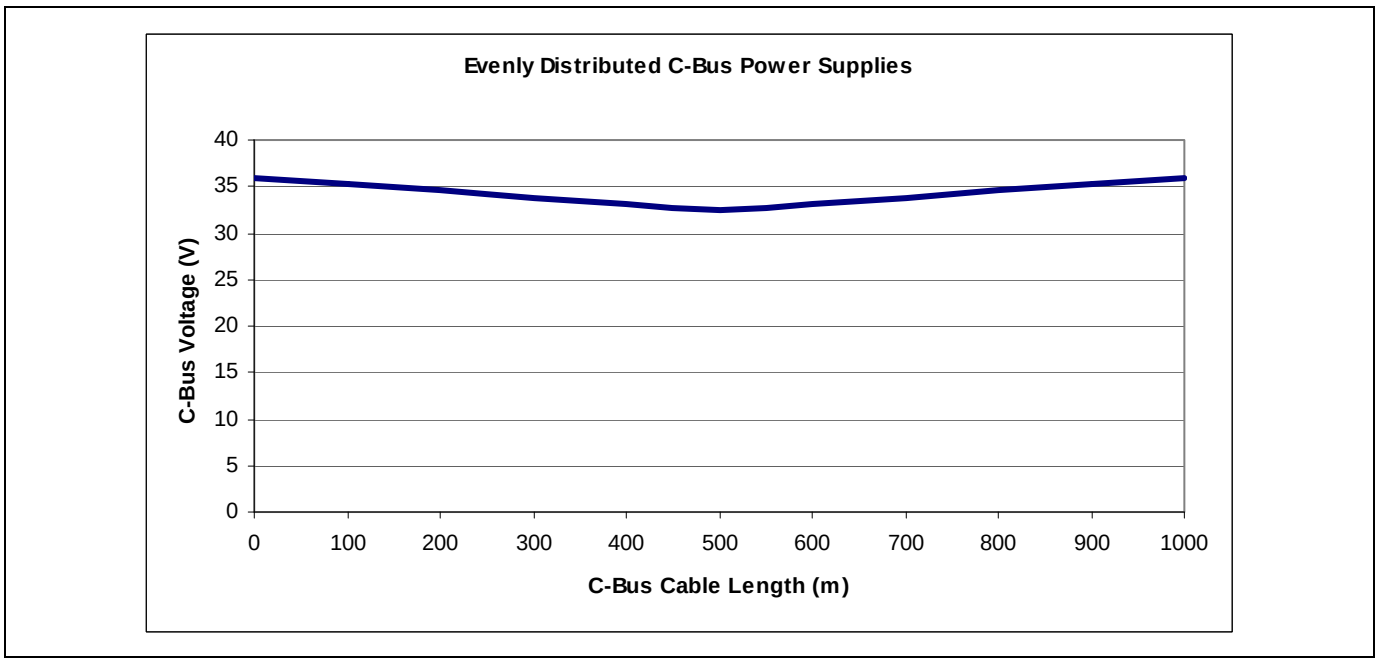


Figure 26 - Voltage drop when power supplies are evenly distributed in a C-Bus network

On a network with conditions as specified above, you will note that there will be an estimated Voltage drop of approximately 3.6 VDC.

Short Circuit and Overload Protection

A C-Bus Power Supply contains electronic protection circuitry, which protects from short circuit and overload conditions. The protection circuitry will react when:

- the positive and negative C-Bus pairs are shorted together
- a C-Bus cable is incorrectly terminated in an RJ45 plug
- the C-Bus network is drawing more current than the power supply can provide.

When the protection circuitry is engaged, the power supply will limit the amount of current that flows to a safe level. This will ensure that the power supply or any other C-Bus units are not damaged.

Over Voltage Protection

It is recommended that sufficient over voltage and lightning protection be installed to protect C-Bus units.

C-Bus Current

Each C-Bus network can only have a maximum of 2 A of current being provided and drawn. Exceeding the 2 A limit could:

- damage the C-Bus cable in a short circuit condition
- cause unexpected behaviour.

The table below lists the different C-Bus power supplies and the amount of current that they provide to the
C-Bus network.

Type Of C-Bus Power Supply	Output Current
DIN Rail Stand Alone	350 mA
DIN Rail Onboard	200 mA
Old Pro Series Dimmer Onboard	60 mA
Matrix Switcher	330 mA

Table 15 - C-Bus Power Supply output currents

NOTE: The full 2 Amps of C-Bus current may not be required for the C-Bus network to operate. Ensure that the current drawn by all C-Bus units does not exceed the total current provided by all C-Bus Power Supplies.

The following example explains how to calculate the required C-Bus current for stable C-Bus operation. To calculate the total amount of current needed to provide power to the network, simply:

1) Add up the current consumption of all of the C-Bus input units and System Support Devices.
2) Ensure that the C-Bus Power Supplies that are being used provide more current than the current being used by all of the input units and System Support Devices.

Input Units and System Support Device Current Calculation			
Unit Type	**Quantity**	**Current Drawn**	**Total Current**
USB PC Interface	1	32 mA	32 mA
4 Button Switch (Standard)	12	18 mA	216 mA
6 Button Switch (Saturn)	5	22 mA	110 mA
8 Button Switch (Neo)	3	22 mA	66 mA
Multi Sensor	5	18 mA	90 mA
Colour Touch Screen	2	22 mA	44 mA
Total Current Draw:			558 mA

Table 16 - Calculating the required C-Bus current

Output Unit Current Calculation			
Unit Type	**Quantity**	**Current Supplied**	**Total Current**
Onboard Power Supply	2	200 mA	400 mA
Standalone Power Supply	1	350 mA	350 mA
Total Current Provided:			750 mA

Table 17 - Calculating the available C-Bus current

NOTE: You may use any combination of C-Bus Power Supplies, but the current drawn must not exceed the current supplied.

C-Bus Current Consumption

When using any combination of C-Bus Power Supplies, it is important to ensure that the current drawn by all
C-Bus units does not exceed the current provided by the C-Bus Power Supplies.

If the current drawn exceeds the current provided, there will be a sharp voltage drop at the limit of the available current.

The figure below shows the effect on the C-Bus voltage when C-Bus units are added to a C-Bus network.

NOTE: When the C-Bus current that is being consumed approaches the amount of C-Bus current being provided, a slight increase in current draw will cause the C-Bus voltage to drop off. To avoid this, it is recommended to provide an extra 100 mA of current (as headroom) for each C-Bus network.

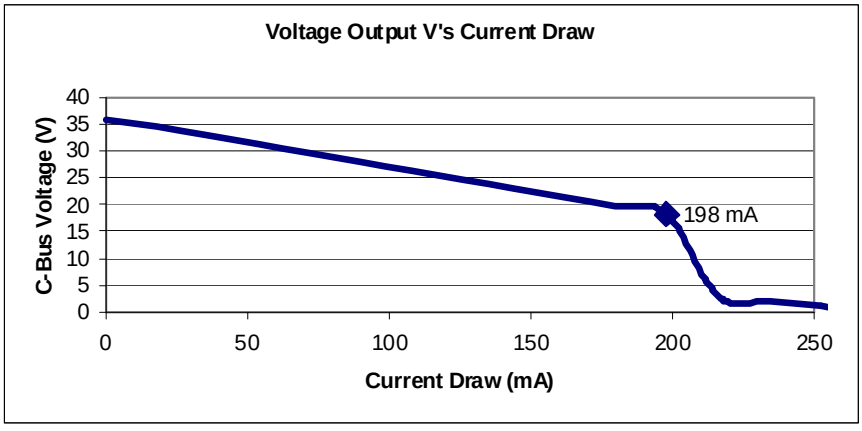


Figure 27 - The effect of C-Bus voltage when drawing too much C-Bus current

C-Bus Clock

When referring to a C-Bus Clock, we refer to a pulse that establishes and synchronises communications on a C-Bus network. Without a C-Bus clock you will not be able to operate or program any C-Bus units.

Each C-Bus network can only have one C-Bus clock active. Although there can only be one active C-Bus Clock on a network, more can be enabled to offer some basic redundancy.

It is recommended that each C-Bus network has a maximum of 3 C-Bus clocks enabled on it. An internal algorithm will decide which clock will be active, and will then deactivate the remaining enabled clocks.

When enabling a C-Bus Clock, try to enable it in the centre of the C-Bus network to avoid attenuation and distortion due to:

- cable length
- cable capacitance
- general interference.

The C-Bus Clock is actually a 5 Vp-p pulse that is superimposed onto the C-Bus DC Voltage. The C-Bus clock can only be viewed using an oscilloscope. The figure below shows a C-Bus clock as viewed through an oscilloscope.

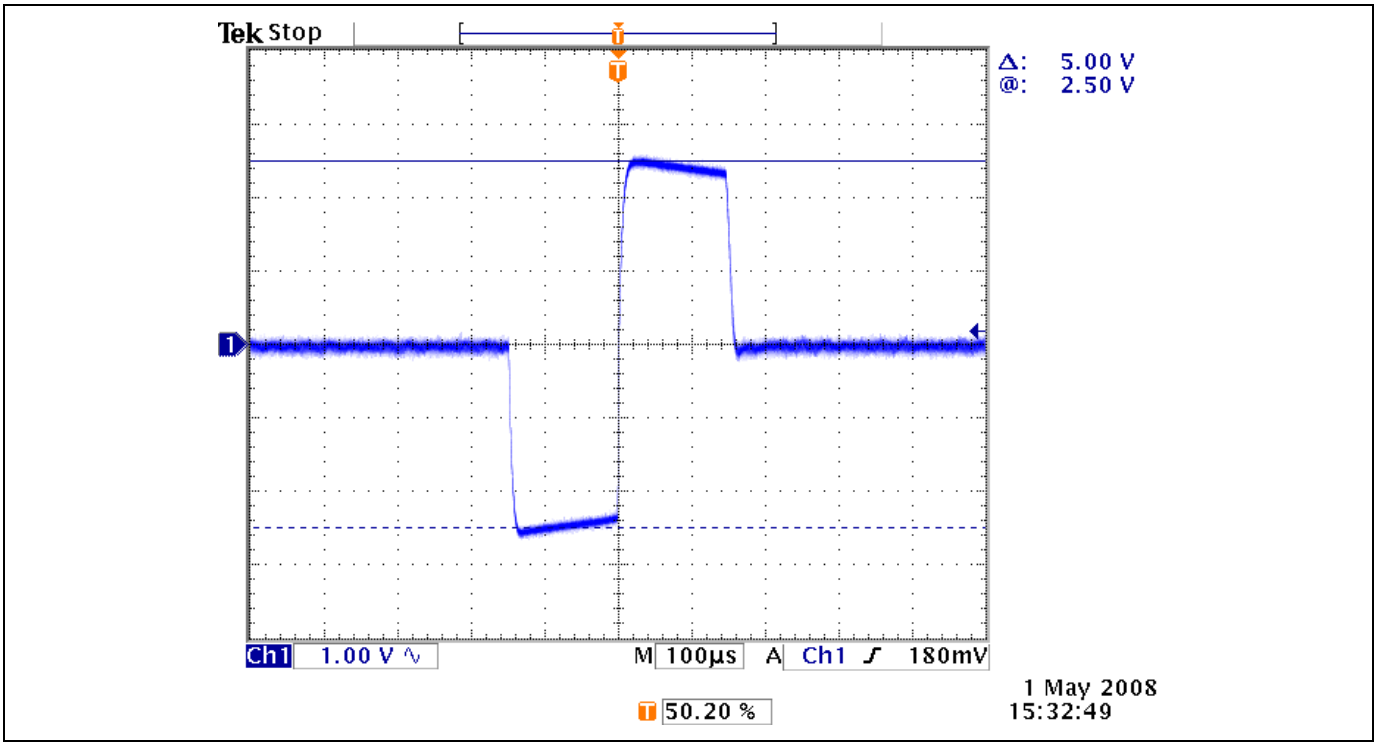


Figure 28 - A C-Bus clock viewed using an oscilloscope

Network Burdens

A C-Bus Network Burden is simply a resistor and capacitor circuit that is placed across the positive and negative C-Bus pairs. Its purpose is to provide the C-Bus network with a standard impedance, ensuring communications are stable and reliable.

All C-Bus networks should have a network impedance between 400 to 1500 Ohms. A network burden should only be connected to the network to adjust the impedance between these two values.

It is recommended that each C-Bus network have a maximum of one Network Burden. However, due to cable capacitance, the number of units and the number of C-Bus Power Supplies, a Network Burden may or may not be required.

NOTE: The table below is developed as a rough indicator to see if a Network Burden may be needed on the C-Bus network. The number of C-Bus units used and C-Bus Cable length will affect the need for adding or removing a Network Burden.

Network Burden Requirement	Number of C-Bus Units
Network Burden required	< 50 C-Bus units
May require a Network Burden	> 50 C-Bus units or < 70 C-Bus units
Should not require a Network Burden	> 70 C-Bus units

Table 18 - Network burden requirement guide

There are two styles of C-Bus Network Burden:

- Hardware Network Burden.
- Software Enabled Network Burden.

A hardware Network Burden is a physical device. It comes in the form of an RJ45 plug with red heat shrink surrounding the resistor and capacitor circuit.

A software-enabled Network Burden is embedded into various C-Bus units, and is enabled and disabled via the Toolkit software or Learn Mode. Software-enabled Network Burdens are available in a wide range of C-Bus units. The list below identifies some of the units with software-enabled Network Burdens:

- All output units
- System Support Devices (PC Interfaces, Touch Screens, Network Bridges etc).

To engage the Software-Enabled Network Burden on an output unit, the unit address must be set to 001 before you enable the Network Burden. To engage the Software-Enabled Network Burden on System Support Device, the unit address may be set to any address between 000 to 254.

NOTE: Where possible it is recommended to use a Hardware Network Burden, as they are easy to identify, easy to add or remove, and if the device goes out the burden is still there.

Mains Segregation

Care must be taken to ensure adequate segregation of 600V Class 1 and C-Bus wiring. Within the confines of a distribution board, the C-Bus cable (which has a 600V Class 1 rated outer sheath) must be used.

Where more than one C-Bus Cable enters the distribution board, care must be taken to ensure that any termination is effectively insulated. Many installations will have all C-Bus cables terminated outside of the distribution board, so only a single C-Bus cable needs to be wired into the distribution board.

To give the greatest margin of noise immunity from the class1 cables, ensure that:

- When running the C-Bus cable in parallel with class 1 wiring, maintain 6 inches minimum separation between the two cables at all times.

  NOTE: Suitable for short distances, for longer runs consider using greater separation.

- When C-Bus needs to cross a class 1 cable, make sure that there is adequate separation of at least
  ½ inch to 2 ½ inches. Also ensure that the C-Bus cable crosses the class 1 cable at a 90^0 angle.

  NOTES:
  These specified requirements are a standard for C-Bus. Should your local Electrical Wiring Code specify greater distances between Class 1 and Class 2 wiring, then ensure the wiring complies.

  Should a C-Bus hardware failure be found due to poor wiring practices, the C-Bus product warranty will be affected.

  The separation and segregation between Mains and C-Bus wiring is one of the key checks made during an Approved Installer site inspection.

Learn Mode

C-Bus Learn Mode

The C-Bus system features a non PC programming method called Learn Mode. Learn Mode allows the units on a C-Bus network to listen to each other and learn their operation by simple button presses on the units.

DIN Rail LED Indicators

On the front of all DIN rail output units, there are 3 types of LED indicators. The:

- Unit indicator
- C-Bus indicator
- local toggle indicators.

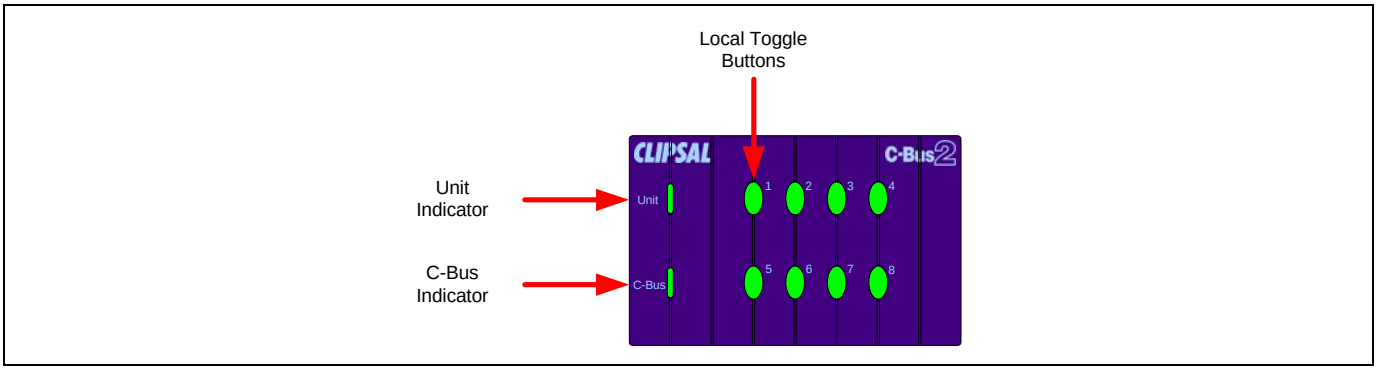


Figure 29 - LED indicators on the front of a DIN rail output unit

The local toggle LEDs show the status of each channel on that particular DIN rail unit. Each local toggle LED is also a button, which can control and override the current status of that particular channel when pressed. These buttons may also be used to program the network without using C-Bus Toolkit, using a process called Learn Mode.

The Unit LED indicates if a mains voltage is present at that particular DIN rail unit. If the Unit LED flashes with a 90% duty cycle, it indicates that a remote or local override has been toggled.

The C-Bus LED indicates the status of the C-Bus network that particular DIN rail unit. For the C-Bus LED to be On, a C-Bus clock and C-Bus voltage must be present. If the C-Bus LED flashes, then the C-Bus voltage may be low.

Not all C-Bus units are Learn Mode enabled. Some commonly used basic C-Bus units that do not have Learn Mode are:

- 1 and 2 channel relays
- C-bus Light Level Sensor
- touch screens
- C-bus Infrared Transmitter.

The source of this functionality is the ability to assign a load (such as a light), with a controller (such as a wall switch), by touching the two units one after the other. This is done while the C-Bus network is in Learn Mode.

NOTE: Learn Mode can be disabled from the C-Bus Toolkit Software to protect the programming of the network.

Entering and Exiting Learn Mode

To enter learn mode, please follow the steps below.

1) Find any Learn Mode output unit.
2) Press and hold down any of the local toggle buttons on any output units for 15 seconds. The Unit and C-Bus LEDs will then begin to flash alternately.

NOTE: The Unit and C-Bus indicators may initially flash together for up to 20 seconds before flashing alternately. Various network parameters are initialised during this time period.

To exit Learn Mode, please follow the steps below.

1) On any of the output units, press and hold down any of the local toggle buttons for 2 seconds.
2) The Unit and C-Bus LED should now be on solid.

NOTE: As a result of entering Learn Mode, the C-Bus clock will then have been successfully enabled on that particular output unit.

If Learn Mode has not been exited successfully within 10 minutes, all units will resume normal operation without storing any changes.

Selecting Output Channels

While in Learn Mode, the local toggle buttons on output units can be pressed. The selected load will be switched on and the appropriate indicator will light up on the output unit. Multiple loads may be selected, across any C-Bus output units.

Selecting Wall Switch Buttons

Once the loads have been selected, the user may choose one or more input units to control those loads. Select the input switch or switches that are required to control the loads.

If you make a mistake simply press the button again to deselect it, and remove it from the current Learn operation.

The simplest association is one involving a single switch and a single load. This would be achieved by the following steps:

1) Enter Learn Mode.
2) Select a channel on a C-Bus output unit.
3) Select a button on a wall switch input unit.
4) Exit Learn Mode.

Any programmed associations between input and output units can be overwritten by a Learn Mode association. To ensure that existing programming is not overwritten, only use each output channel and each button on an input once.

Learn Mode Operations

C-Bus Learn Mode can be used to create a variety of flexible control configurations. Basic On/Off switches can be configured as well as Dimmer and Timer controls.

Relay and Dimmer Configurations

The type of control function assigned to the button on an input unit, depends on whether Learn Mode is exited via a relay or dimmer output unit:

- For a switching control function, exit on a relay unit.
- For a dimmer function exit Learn Mode on a dimmer unit.

When a C-Bus relay output unit is used to exit Learn Mode, any buttons (on input units) included in that Learn Mode association will be programmed with the On/Off key function.

When a C-Bus dimmer output unit used to exit Learn Mode, any buttons (on input units) included in that Learn Mode association will be programmed with the Dimmer key function.

Two Button Configurations

The single button On/Off or Dimmer configuration may be extended so that one button turns the load on, and one turns it off. This is done during Learn Mode by pressing two adjacent buttons on the same input unit.

After exiting from Learn Mode, the:

- first button will turn the load on
- second button will turn the load off.

When the On button on the input unit is pressed the indicators on both buttons will light up, since they are both associated with the same load. When the Off button on the input unit is pressed, the indicators will both turn off.

This configuration may also be applied when using C-Bus dimmers. Where one button on and input is assigned a Dimmer Up key function, and the other button is assigned a Dimmer Down key function.

Area Address Switching

Area address switching functions give the ability to provide a Master On/Off switch that turns all lights and loads on or off simultaneously.

It is assumed that the primary function of the button is intended to be as a Master Off switch. Hence a short press of the button will instantaneously turn off all selected lights and loads. A long press on the button will turn them all on.

To implement area address switching:

1) Set the network into Learn Mode.

2) Turn on all local toggle buttons.
3) Select a C-Bus button to control the area address.
4) Exit Learn Mode.

Master switching controls should be configured last using Learn Mode. Control of each individual is not affected for any unit that has master switching implemented.

NOTE: Some temporary indicator state mismatches may occur when Units are operated in this way; however these are normally resolved automatically in seconds.

Timer Configurations

The C-Bus system offers many timer options and some of these are available by means of Learn Mode. To create a timer on an input switch:

1) Set the network into Learn Mode.
2) Select a channel on a C-Bus output unit.
3) Press and hold a button on an input unit until the indicator flashes.
4) Exit Learn Mode.

The button indicator will come on after 1 second with a series of double flashes. Each double flash represents a time period of 5 minutes. Exit Learn Mode to assign the timer to the wall switch button. If Learn Mode is exited immediately after the first double flash, a 5 second timer will be set to the wall switch button. This can be useful for testing purposes.

Super Learn Mode

Super Learn Mode is a powerful function, allowing the user to:

- reset group addresses on an output unit to $FF Unused
- reset area addresses on an output unit to $FF Unused
- view the status of the network burden on an output unit
- manually enable or disable the network burden on an output unit.

Entering Super Learn Mode

A C-Bus output unit is placed into Super Learn Mode by double clicking a local toggle button While that unit is in Learn Mode.

When in Super Learn Mode, all load channels on that output unit will turn on, and the Unit indicator will flash rapidly. The C-Bus indicator then shows the state of the burden for that unit. If the C-Bus indicator is on, then the burden is enabled. If the C-Bus indicator is off, then the burden is disabled.

Enabling the Software Selectable Burden

Super Learn Mode can also enable and disable the software selectable network burden. This is done by double pressing a local toggle button While in Super Learn Mode. If successful, the C-Bus indicator should turn on or off accordingly.

Resetting to Defaults

Super Learn Mode may be used to clear group addresses from output units and restore other factory default settings.

When a unit is placed in Super Learn Mode all channels on that unit are turned on by default. Individual channels may be deselected as required. Upon exiting Super Learn Mode, all group addresses for the selected channels (in the selected output unit) will be reset to Unused.

C-Bus Addressing

C-Bus Addressing

For each site that has C-Bus installed, C-Bus Toolkit will create a project that contains all of the programming information. This includes all addressing information associated to that specific site.

C-Bus utilises a number of different addressing methods, to allow C-Bus input and output units communicate with each other. These addresses are:

- network address
- unit address
- application address
- group address
- area address
- levels.

C-Bus Toolkit allows you to assign meaningful names to various address types. These meaningful names are referred to as tags.

Multi-Network Connectivity

Communications between multiple C-Bus networks can be achieved by using a C-Bus Network Bridge. Multiple C-Bus networks are required when:

- more than 100 C-Bus units are needed (or calculated max)
- more than 1 km of C-Bus cable is needed
- more then 2 A of current is provided
- separation of networks is required.

A C-Bus Network Bridge will:

- allow all C-Bus networks to be programmed from a central location
- pass Bi-directional C-Bus commands from one network to another.

NOTE: The C-Bus Network Bridges may be configured not to pass C-Bus messages, or not to pass C-Bus messages in a particular direction.

A C-Bus

Projects may contain up to 255 C-Bus networks configured in four possible network layouts:

- daisy chain topology
- star topology
- a combination of daisy chain and star topologies
- ring topology.

NOTE: Ring topologies are rarely used as they are complex to commission, and require a large number of C-Bus Network Bridges.

When using a daisy chain network topology, a maximum of seven C-Bus Networks (6 Network Bridges) can be placed one after another.

The deeper you go into the chain of C-Bus networks, you will find that there is more propagation delay when programming and sending commands. As a result it is recommended not to make a network Daisy Chain more than four C-Bus networks deep.

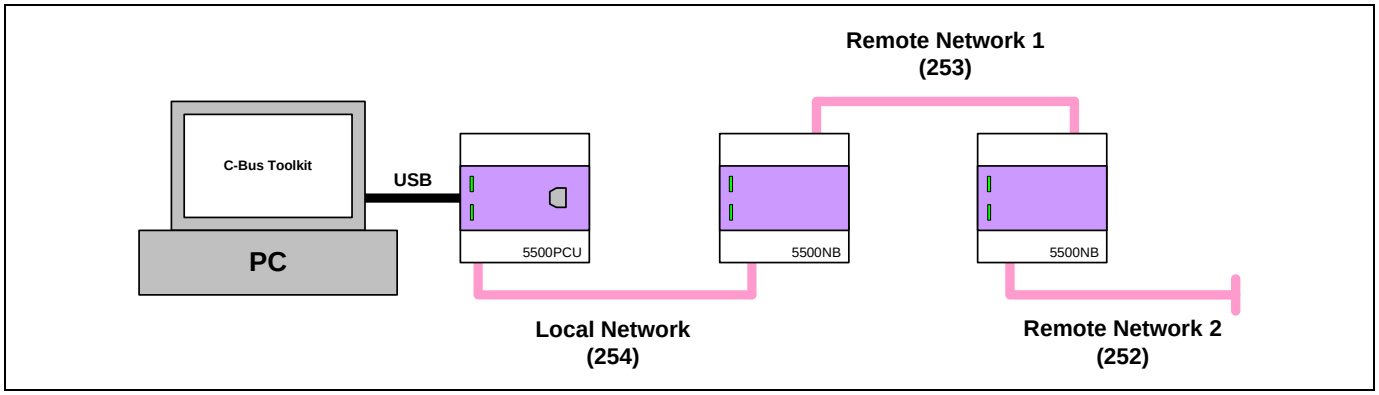


Figure 30 - Daisy chain network topology

A star network topology is when a number of C-Bus networks all connect back to a single C-Bus network. Less than 100 C-Bus networks may be connected to a single C-Bus network in a Star Network topology (remembering that only 255 networks may be added to a single Toolkit Project).

The C-Bus network that all other C-Bus networks connect to is commonly referred to as a C-Bus Backbone network.

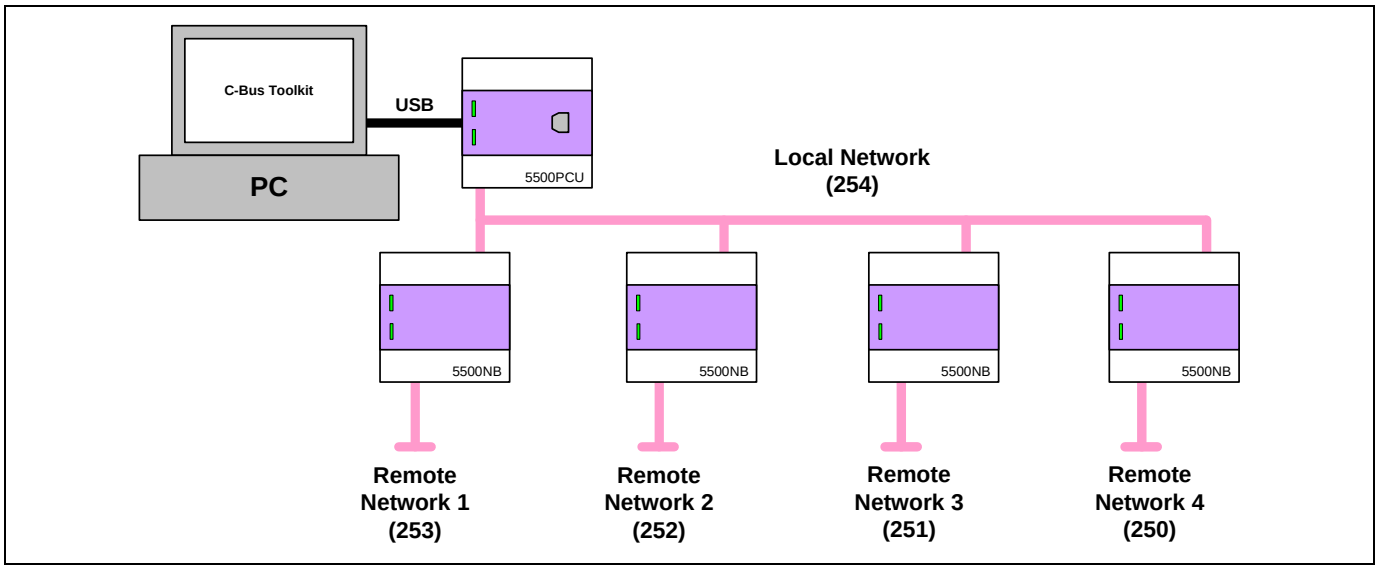


Figure 31 - Star network topology

A Combination Network topology refers to a mixture of C-Bus networks connected in Daisy Chain and Star network topologies.

When using a Combination Network topology, ensure that there are less than 100 C-Bus networks connected to a single C-Bus network. Also ensure that the Daisy Chain networks are no more than the recommended four networks deep.

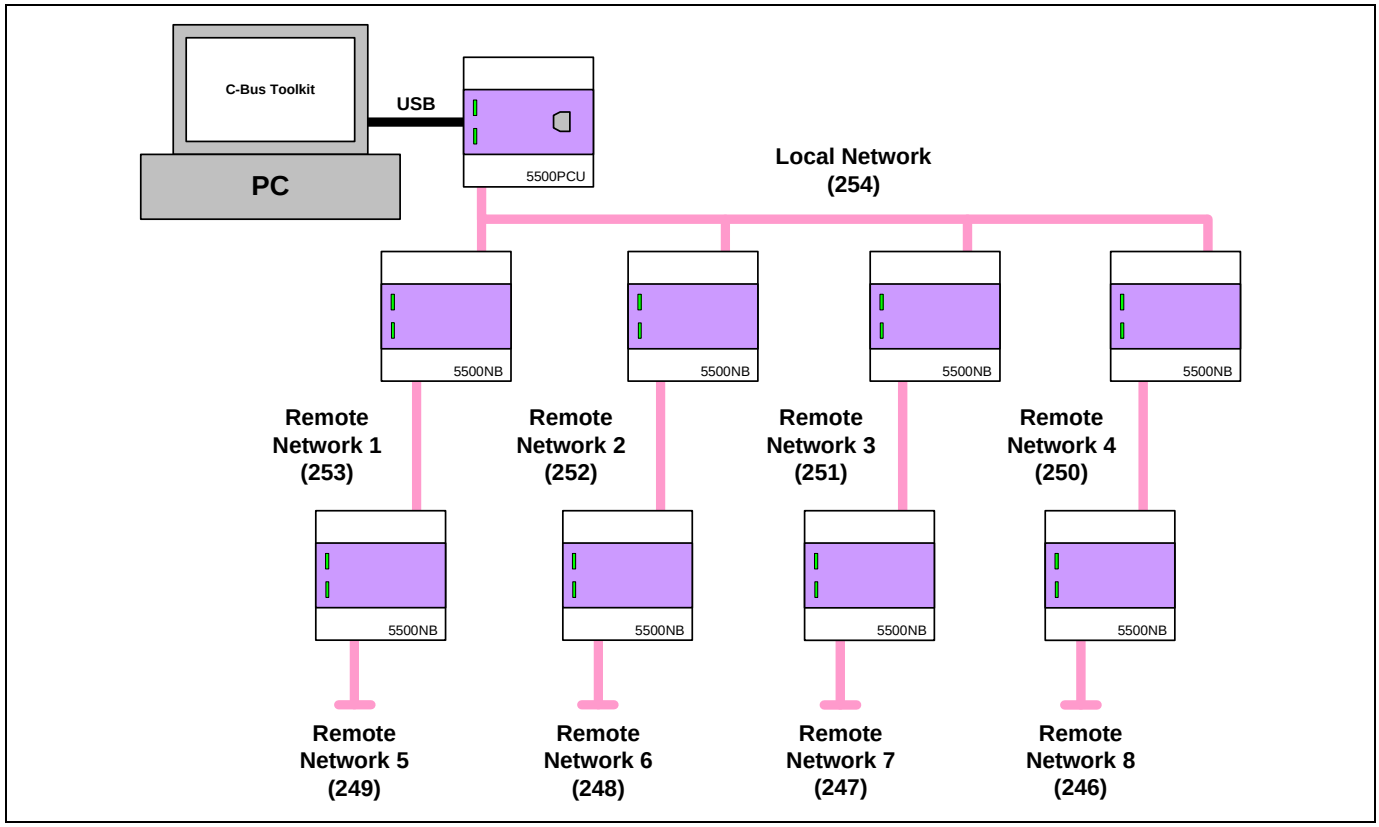


Figure 32 - Combination of daisy chain and star network topology

Network Address

A C-Bus network is a collection of up to 100 C-Bus devices connected together using Category 5 data cable. Each C-Bus project is capable of having up to 255 C-Bus networks installed.

The network address is the number assigned to each C-Bus network within a particular Project. The C-Bus Toolkit Software allows the configuration of C-Bus network layouts and addressing.

The default network address for a C-Bus network is 254. Each time a C-Bus network is added to a project, the network address is decremented from 254, to 253 to 252 etc.

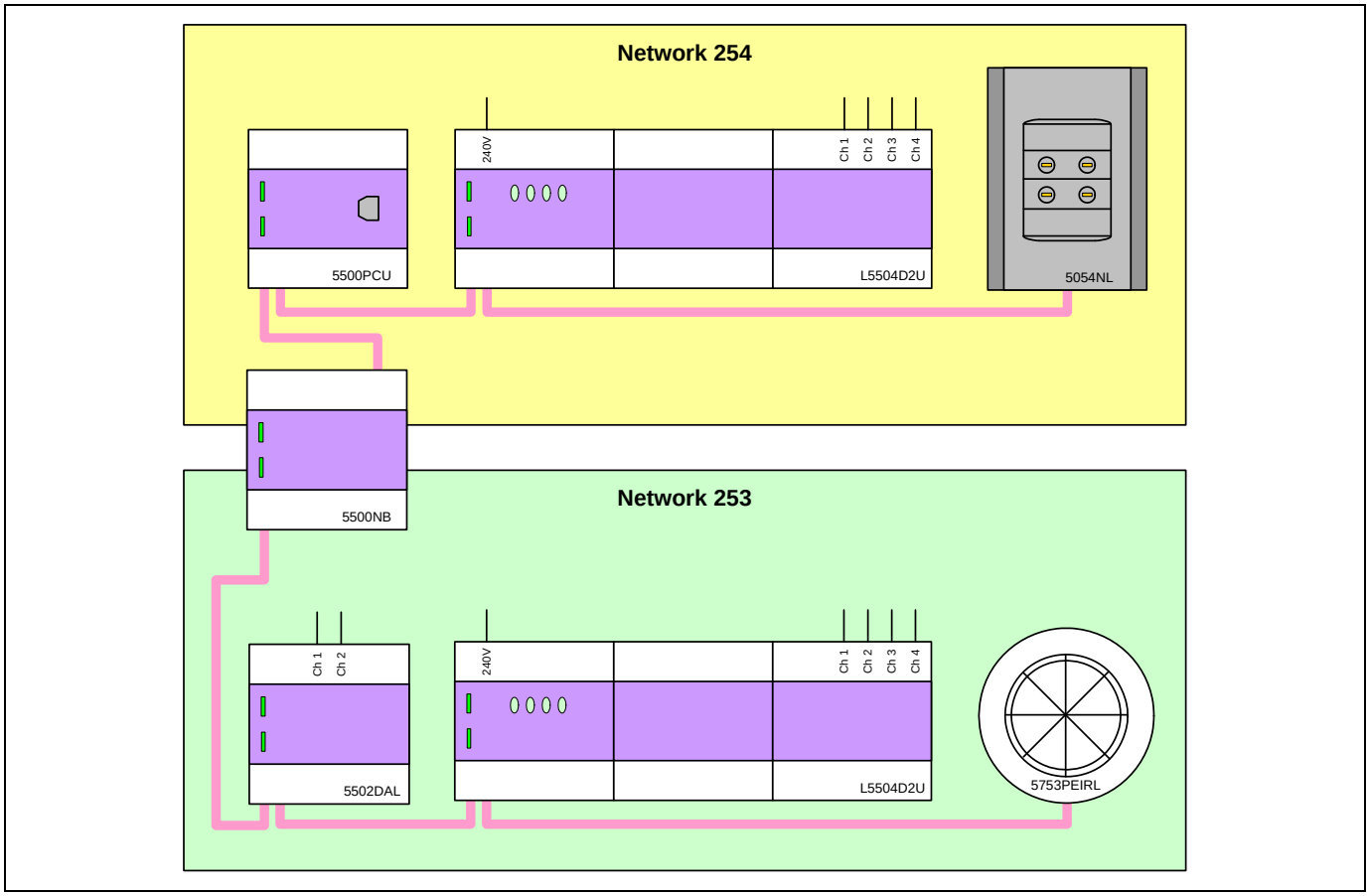


Figure 33 - C-Bus networks 254 and 253 connected to each other through a Network Bridge

Unit Address

All units on a C-Bus network have a unique identification number called a unit address. The unit address allows the C-Bus Toolkit software to send programming information directly to a specific C-Bus unit. This will allow you to program individual C-Bus units without removing them from the C-Bus network.

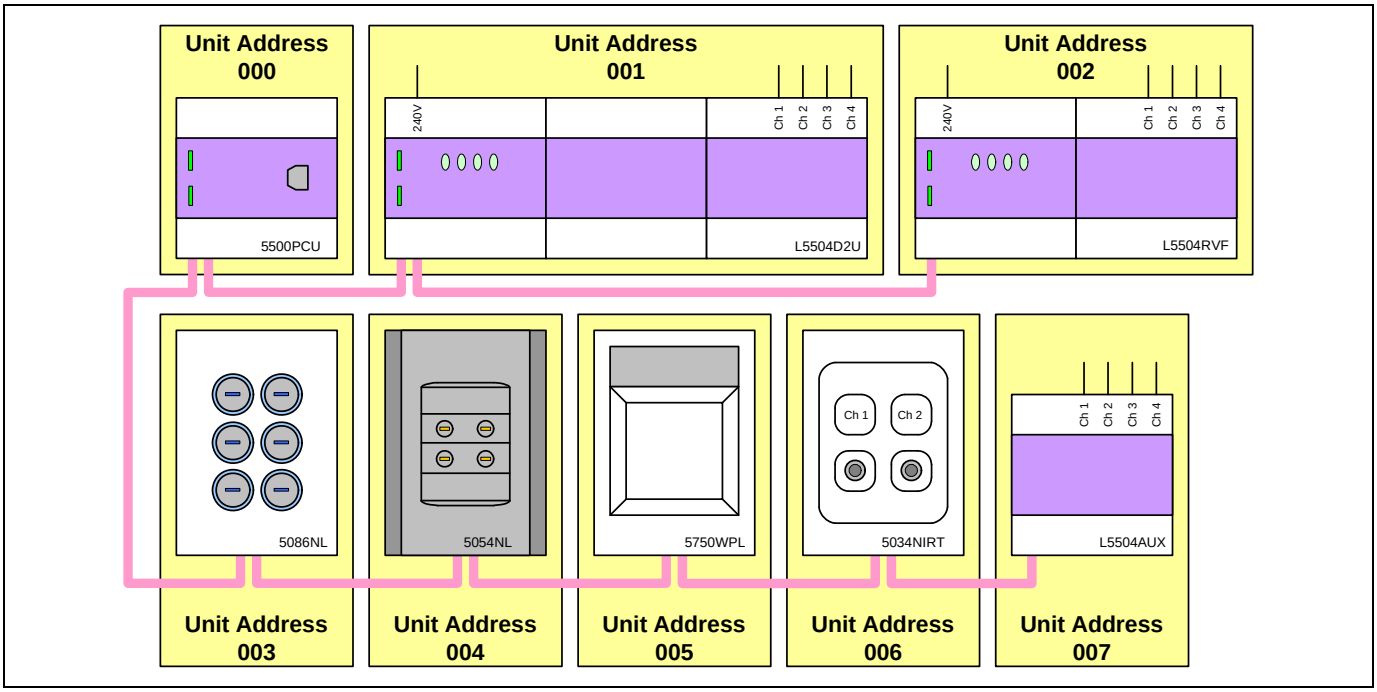


Figure 34 - Unit addresses assigned to each C-Bus unit

The unit address is also used in conjunction with other C-Bus products to provide monitoring of the:

- C-Bus voltage of that unit
- temperature of a temperature sensor
- Lux of a Light Level Sensor.

NOTES

Standalone C-Bus Power Supplies are the only C-Bus units that are not physically programmed with a unit address. C-Bus Toolkit databases will show all C-Bus hardware with associated unit addresses.

All C-Bus units have a default unit address of 255.

Software enabled Network Burdens can only be enabled on a C-Bus output unit at Unit Address 001.

Application Address

An application address is an address that allows C-Bus units to be separated into different functional categories for different uses e.g. Lighting, Heating, Irrigation etc. Most C-Bus units are set to the Lighting application by default.

This means that C-Bus units on the Lighting application are isolated from C-Bus units on the Heating application. Thus there will be no communication between units on different C-Bus applications.

NOTE: Some C-Bus input units have the ability to communicate to two or more C-Bus applications.

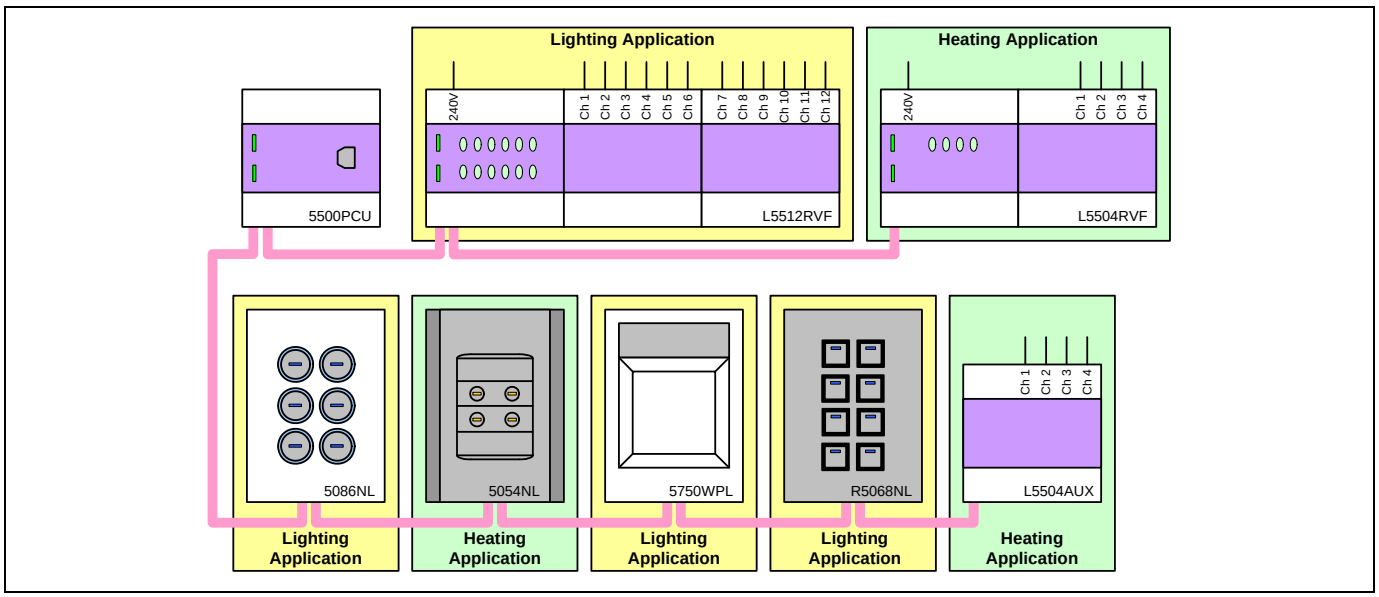


Figure 35 - Only C-Bus units on the same application will communicate to each other

While C-Bus allows the use of different applications, it is critical that all application addresses are used fall within the correct ranges. The table below outlines the reserved application addresses.

Application Name	Application Address
Free applications for developers.	000 to 015
Temperature Broadcast	025
Lighting	048 to 095
Irrigation	113
Pool, Spa, Fountain or Pond	114
HVAC Actuator 1	115
HVAC Actuator 2	116
Heating	136
Air Conditioning	172
Trigger Control	202
Enable	203
Audio Visual	205
Measurement	228

Table 19 - Reserved address ranged for the application addresses

Group Address

A group address is used to make associations between the button of an input unit and the channel of an output unit. They are used to emulate physical connections between loads and switches. Any C-Bus messages that are sent by an input unit will only change the state of the channels on an output unit with the same group address. This allows:

- A number of C-Bus output unit channels to be controlled by a single button on a C-Bus switch (with the same group address)
- A number of buttons on different input units to control the same load, by giving them all the same group address.

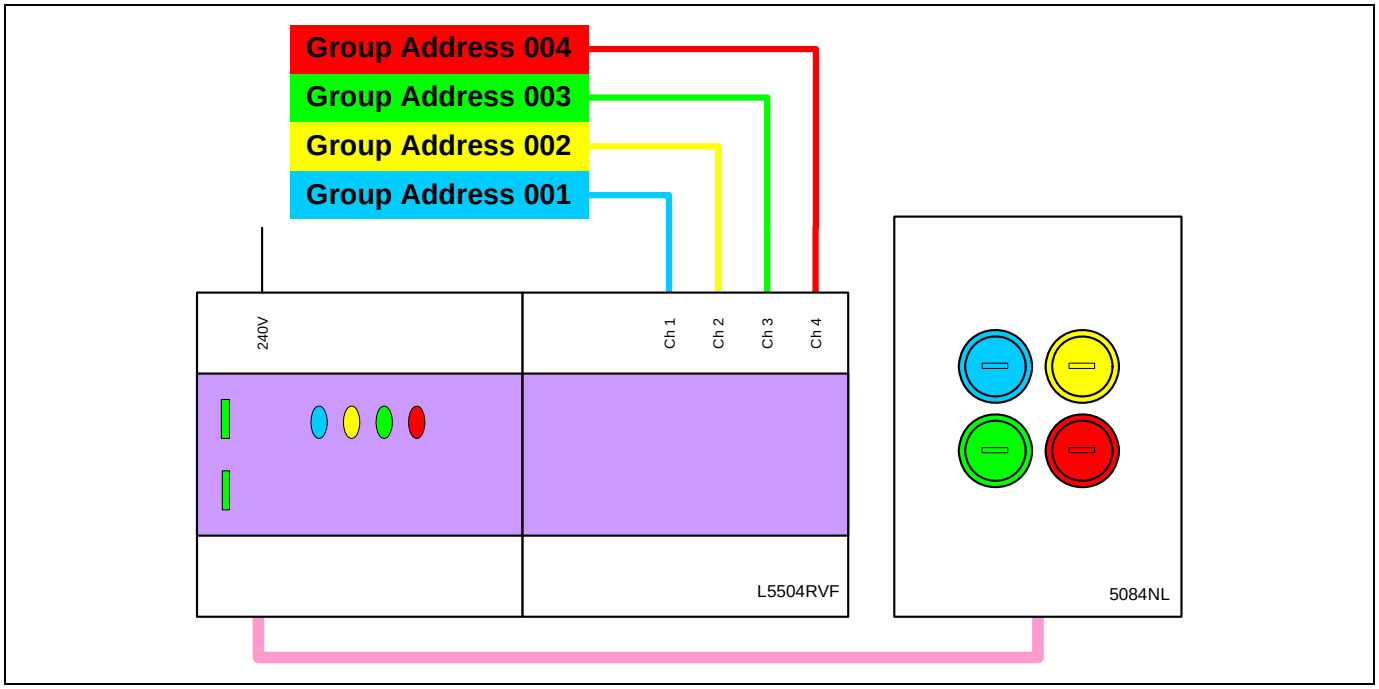


Figure 36 - Group addresses associating buttons on an input unit to channels on an output unit

Inside of an application address, there are 256 group addresses (0 to 255). C-Bus allows the creation of up to 255 different group addresses on each application address.

NOTE: Group address 255 is a reserved group address. This reserved address is associated to the default setting of <Unused>.

Area Address

An area address is a C-Bus address that allows the control of all channels of C-Bus output units.

An area address is actually a group address that is programmed into a different memory location in a C-Bus unit. The area address will force all channels on the output unit to follow the level of the group address that is controlling it.

NOTE: An area address will only respond when it sees a change of state. Sending an OFF command to an area address that is already OFF will have no effect.

NOTE: Misuse of an area address may result in the unexpected behaviour of a C-Bus network. While this function may easily be used as a Master Control for the C-Bus network, it is not the best solution. An example of this is turning ON all channels on output units, at the same time. This will result in excessive inrush currents.

Levels

Every group address has 256 steps between OFF (0 and 0%) and ON (255 and 100%). These 256 steps are referred to as levels.

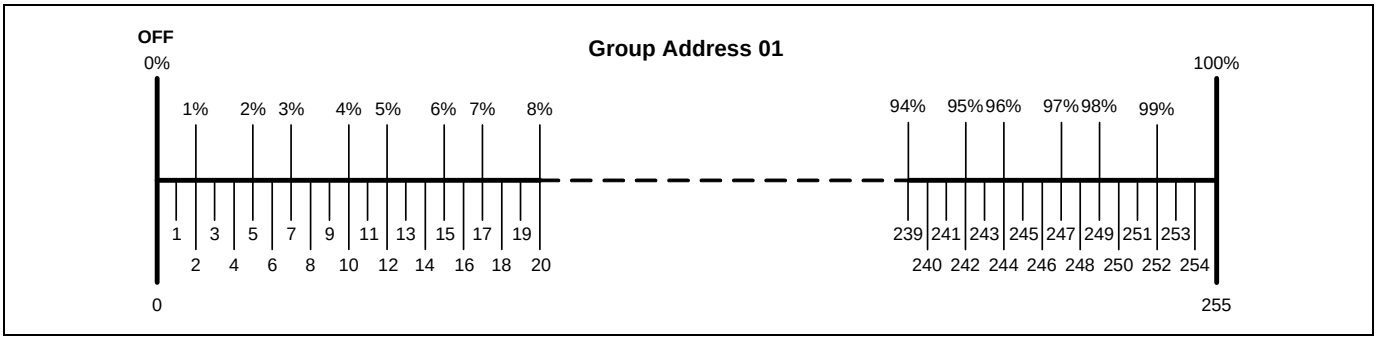


Figure 37 - Levels inside a group address

Levels are occasionally referred to differently, depending on which C-Bus application address the group address is on. When the C-Bus group address is on the:

- Lighting application, the 256 steps in a group address are referred to as levels
- Trigger Control application, the 256 steps in a group address are referred to as action selectors
- Heating application, the 256 steps in a group address are referred to as levels
- Enable application, the 256 steps in a group address are referred to as values.

Levels and action selectors are most commonly used to trigger an event (like a scene) from a remote location.

C-Bus Tags

Since all C-Bus addresses range between 0 and 255, it is more user friendly to give each address a meaningful name. A C-Bus tag is simply a meaningful name that is given to a C-Bus address.

Example network address tags:

- Local Network
- Remote Network
- Floor 1
- East Wing
- West Wing
- Level 1

Example application address tags:

- Lighting
- Enable
- Heating
- Trigger Control
- Irrigation
- DALI

Example group address tags:

- Kitchen Light
- Main Bedroom WIR
- Fountain Pump
- Toilet Fan
- Lounge Wall Lights
- Hall Wall Lights

Example level tags:

- Welcome Home Scene
- Master Off
- Mood 1 Trigger
- Goodbye Scene
- Master Override
- Mood 2 Trigger

NOTE: C-Bus tags are stored in the C-Bus Toolkit software and not in the C-Bus units. The only addressing information stored in C-Bus units, are the numeric addresses (0 to 255). This means that if you do not have a copy of the Toolkit database, a scan of the C-Bus network will only show numeric addresses rather than the tag.

How C-Bus Works

When a button on a C-Bus input unit is pressed, a C-Bus command is generated.

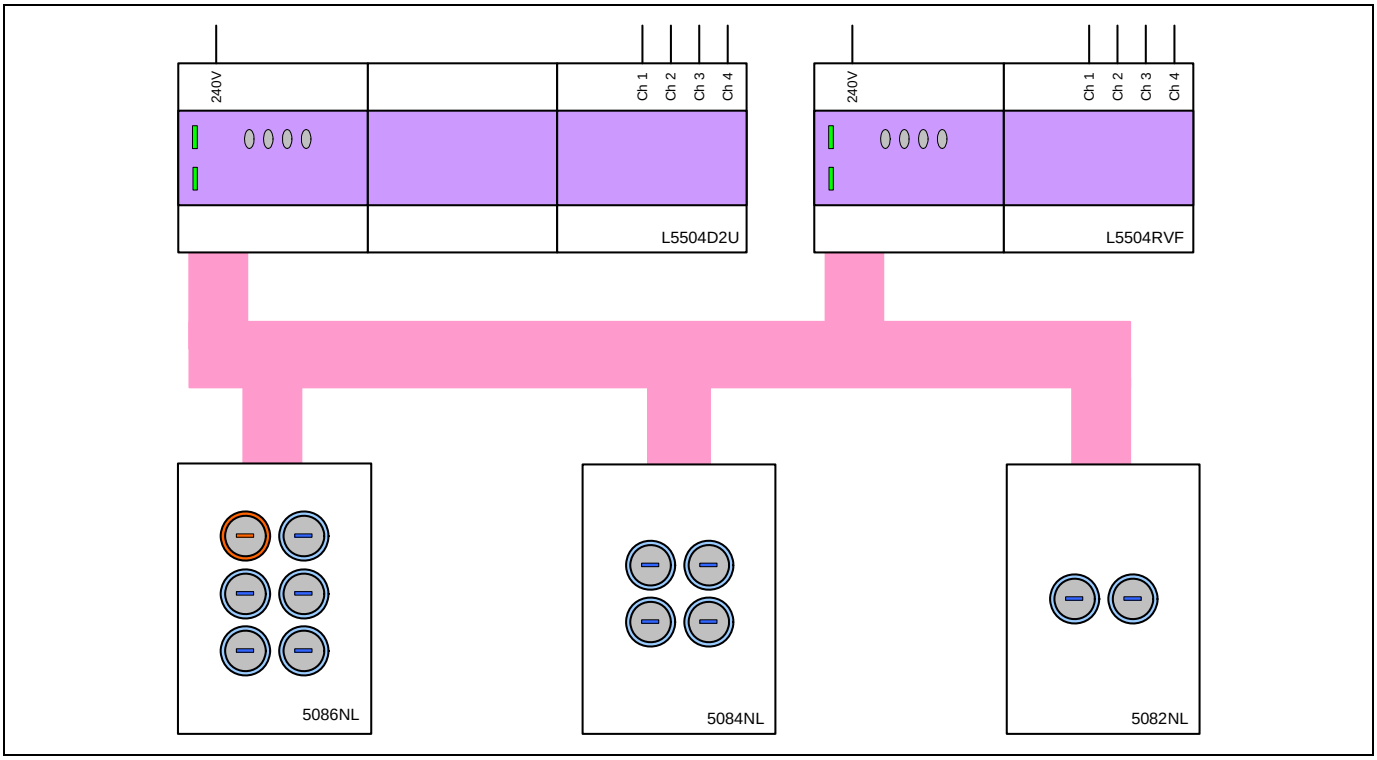


Figure 38 - Button 1 on the 6 button switch is pressed

Once the command is generated, it is transmitted onto the C-Bus network.

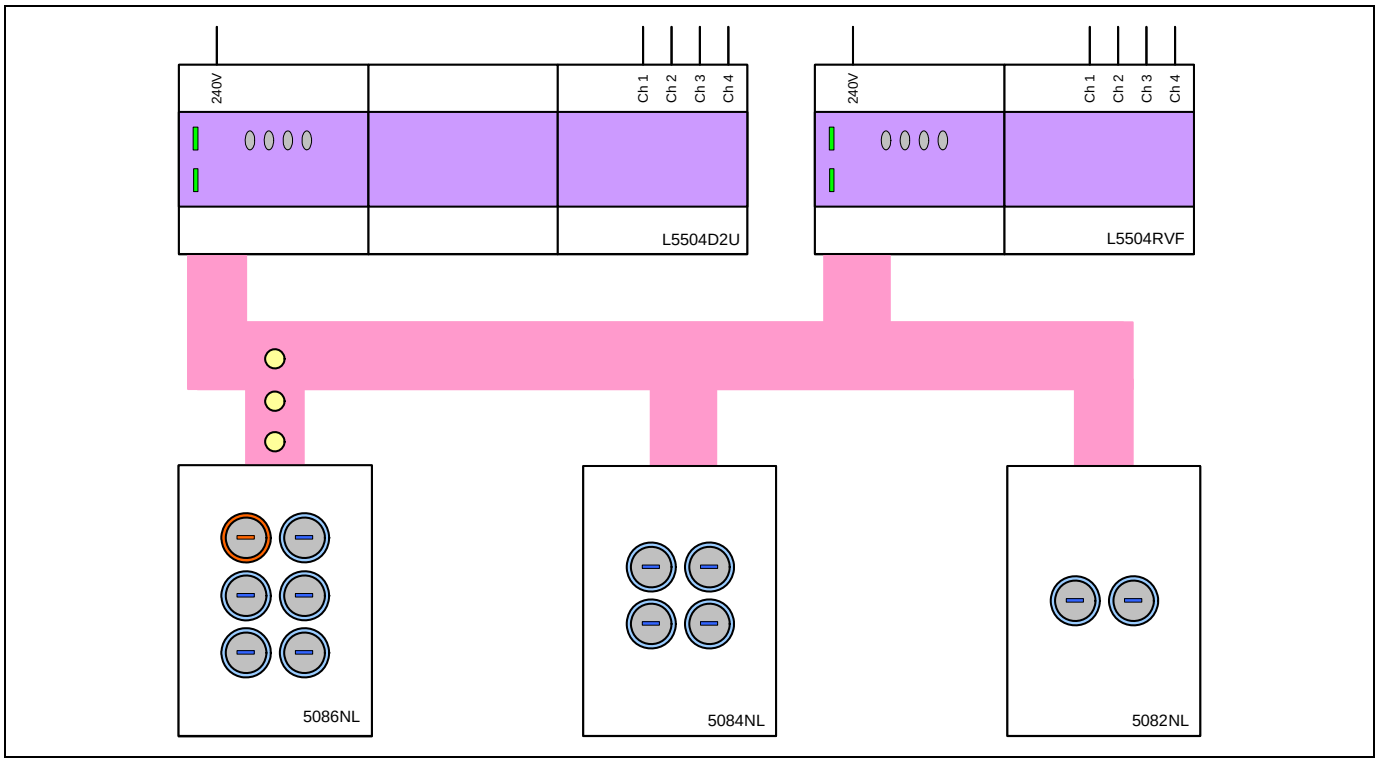


Figure 39 - The 6 button switch transmits a command onto the C-Bus network

Once the command is transmitted onto the C-Bus network, it will be seen by every other C-Bus unit on that network.

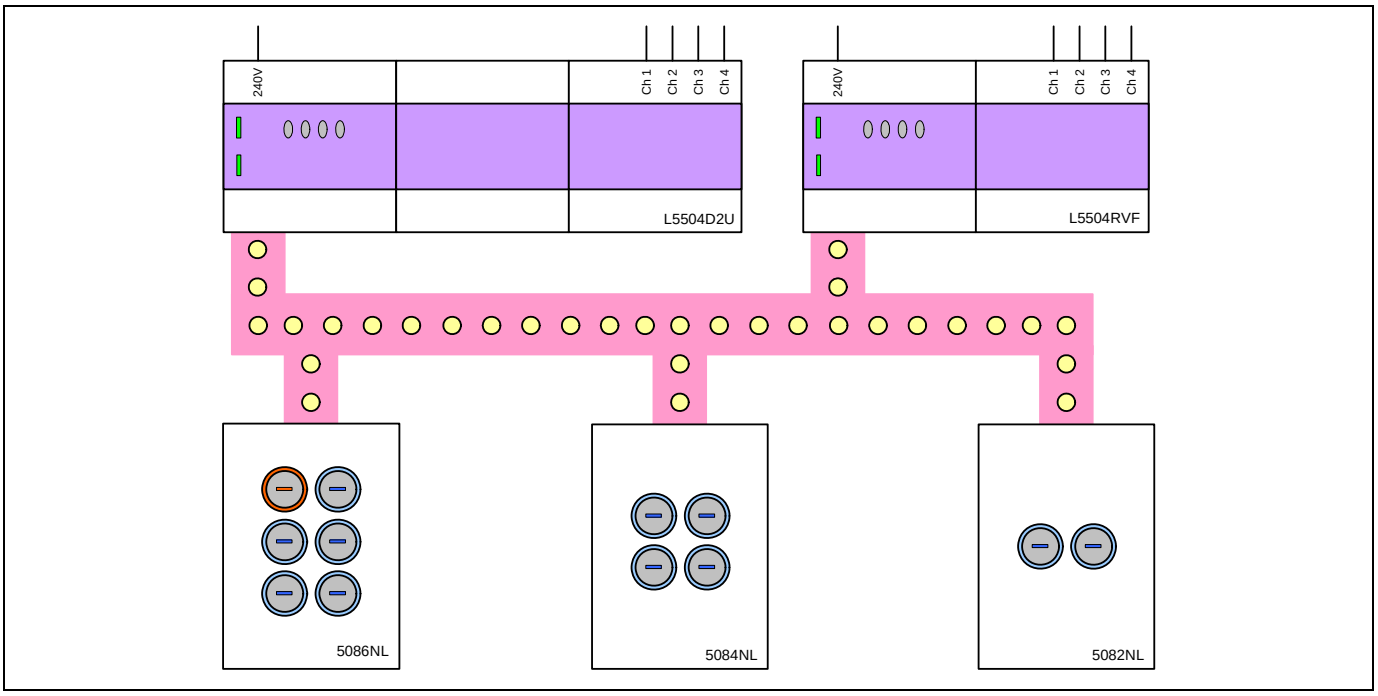


Figure 40 - The C-Bus command is seen by all C-Bus units

Only the C-Bus units with the same group address on the same application address will respond by:

- controlling a channel on an output unit
- controlling an indicator on an input unit.

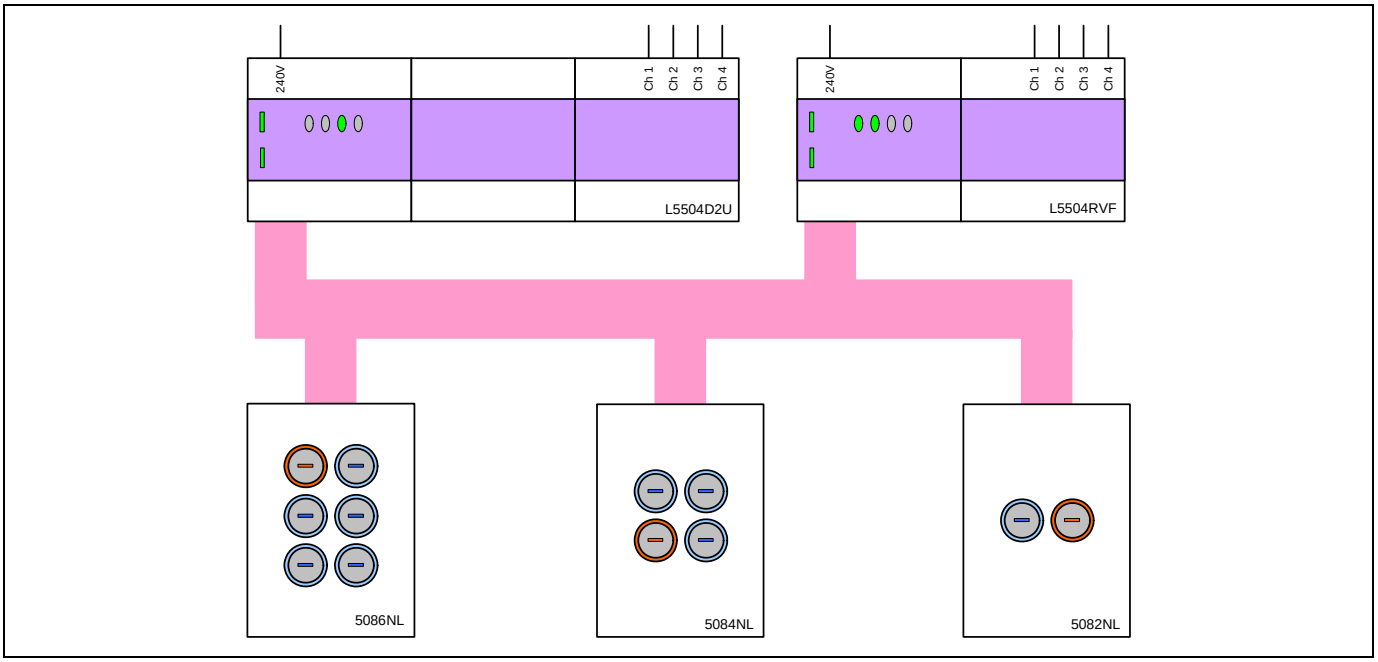


Figure 41 - Only units that share the same addresses will turn on their channels and indicators

C-Bus Message Types

All C-Bus Key Functions (On/Off, Dimmer, Timer, Preset, Bell Press etc) consist of these three message types. The C-Bus messages that can be transmitted by any C-Bus input units:

- On Commands
- Off Commands
- Ramp to Level Commands.

The On and Off commands will set a C-Bus group address to the On or Off state. A Ramp to Level command will ramp a group address:

- to a specific level
- over a specific period of time.

NOTE: C-Bus timers are controlled via the programming inside the input unit. Once a C-Bus timer is started it will decrement the time in 1 second intervals. The maximum time that a C-Bus timer can count is 18 hours, 12 minutes and 15 seconds.

Status Report Interval

The Status Report Interval (SR Interval) is a highly efficient reporting technique used by C-Bus. Its main purpose is to ensure that all group addresses on a single given C-Bus network are in sync with each other.

If the Status Report detects that group addresses are out of sync, the units on the network will automatically self correct the discrepancy. A Status Report occurs every 3 seconds by default. This means that if a discrepancy is found, it will be corrected within a few Status Report cycles.

The Status Report is generated for every Lighting application that exists on a C-Bus network. Some C-Bus units may initiate Status Report's regardless of which application address they are using. When a Status Report is initiated, units will buffer any C-Bus commands until the Status Report has completed its error checking for that particular application.

C-Bus Into to Toolkit

C-Bus Toolkit

The C-Bus Toolkit Software is primarily used to:

- program the majority of C-Bus units
- commission C-Bus projects.

PC Requirements

When installing C-Bus Toolkit onto a computer, ensure the computer meets the following preferred specifications:

- Windows XP Professional
- Pentium 4 processor, 2 GHz or Core 2 Duo processor E6300 or better
- 512 MB RAM or greater
- 40 GB hard drive with 5 GB free space or greater
- Mouse
- Screen resolution of 1024 x 768 or better
- Network adaptor (10 Mbps or better)
- 2 × USB Ports
- 1 × Serial COM port.

C-Bus Toolkit Overview

Once the Toolkit Software has been opened, the software will look similar to the screen below. There are four distinct areas of the Toolkit Software:

- C-Gate console
- Toolkit main menu
- Navigation tree
- the toolbar
- Programming window.

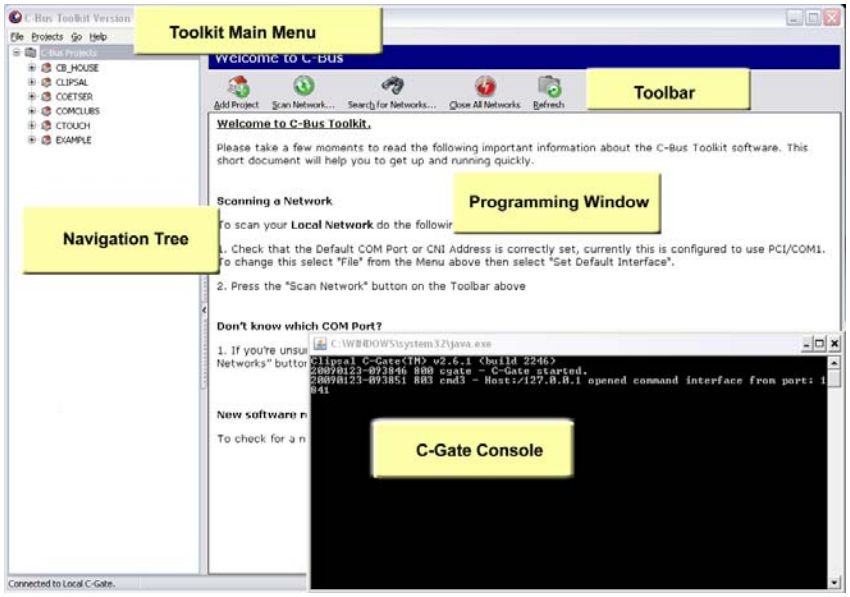


Figure 42 - The C-Bus Toolkit software

The C-Gate Console

The C-Gate console is a critical component in the operation of all Clipsal Integrated Systems software. It contains programming information about every C-Bus project that is created by C-Bus Toolkit. Stored inside C-Gate is information on each:

- C-Bus project
- C-Bus network in a project
- application address on a network
- group address on an application address
- Level of a group address
- Tag description for any address type
- C-Bus unit and its programming in a database.

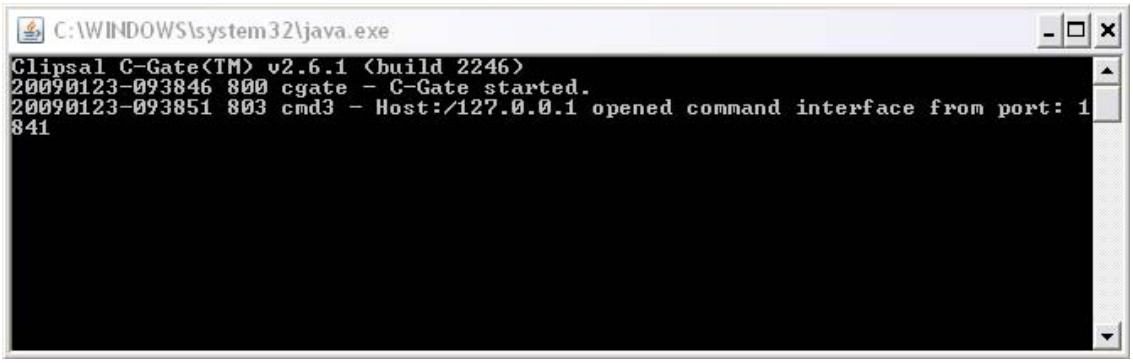


Figure 43 - The C-Gate console

The following points outline the behaviour of the C-Gate console:

- C-Gate opens automatically each time you open most Clipsal Integrated Systems software package.
- C-Gate opens in a separate window to C-Bus Toolkit (a console window).
- Shutting down C-Gate console while using programming software will cause errors (the software will need to be closed and restarted).
- Only one instance of C-Gate console can run on a PC at any one time.

CAUTION

DATABASE CORRUPTION IS POSSIBLE WHEN USING MULTIPLE PROGRAMMING SOFTWARE

Do not connect multiple programming software, such as Toolkit and PICED, to a single version of C-Gate.

Failure to follow these instructions can result in project database corruption.

Connecting a number of different programming software packages (e.g. Toolkit and PICED) to a single version of C-Gate, may corrupt the project database. If you wish to do this, ensure you do not create any type of address while both packages are open.

The Toolkit Main Menu

The Toolkit main menu consists of 4 menu sections:

- File
- Project
- Go
- Help.

The File section of the main menu allows you to:

- connect and disconnect to a local or remote repository (C-Gate on a local or remote PC)
- select a default programming interface e.g. default COM port of the serial port
- configure the behaviour of C-Bus Toolkit in the Preferences settings
- backup and restore C-Bus Toolkit projects
- install USB drivers
- exit the C-Bus Toolkit software.

The Project section of the main menu allows you to:

- add and delete C-Bus projects
- scan C-Bus networks
- search for C-Bus networks
- close C-Bus networks
- refresh the Toolkit Software
- import and export C-Bus projects to the C-Bus V2 software format.

The Go section of the main menu allows you to select, expand and contract various nodes in the Navigation tree. It provides access to the following nodes:

- Project (Shortcut = CTRL + 1)
- Networks (Shortcut = CTRL + 2)
- Application (Shortcut = CTRL + 3)
- Units (Shortcut = CTRL + 4).

The Help section of the main menu allows you to:

- access Toolkit Help
- visit the Clipsal Integrated Systems website
- check for C-Bus Toolkit updates
- report a problem with C-Bus Toolkit
- view “What’s New” information about the Toolkit software
- view version information about C-Bus Toolkit.

The Navigation Tree

The Navigation tree is displayed on the left hand side of the C-Bus Toolkit software. It manages the details of every C-Bus project you create with C-Bus Toolkit. The image below identifies the different nodes on the Navigation tree.

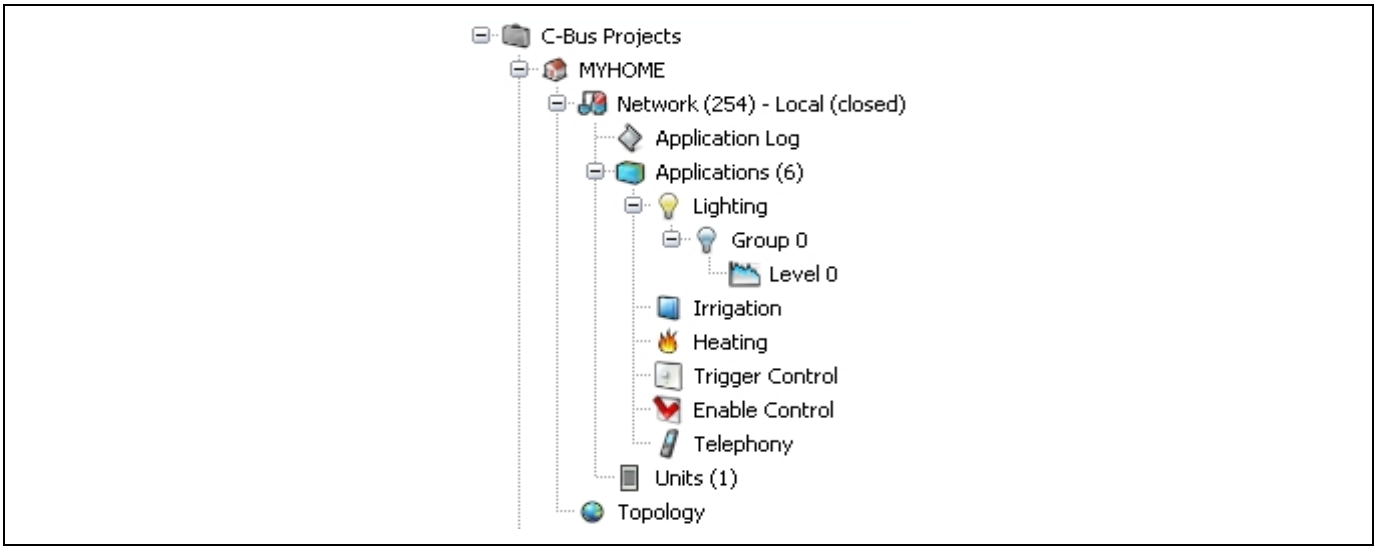


Figure 44 - A typical Toolkit Navigation tree

NOTE: Depending on which node of the Navigation tree is selected, the Toolkit toolbar and Programming window will display different buttons and programming information.

Each node in the Navigation tree has a specific purpose, as listed in the table below.

Node	Description
Project repository	The Project Repository is the instance of C-Gate that the Toolkit software connects to. Toolkit will always connect to the C-Gate console on the same PC by default. New C-Bus Projects may be added from this node.
C-Bus project	The C-Bus Project node is unique for each C-Bus installation you program. This node is commonly used to add, open and close C-Bus Networks in the selected project.
C-Bus network	The C-Bus Network node will allow general network information to be displayed and configured for the selected C-Bus network.
Application log	The Application Log node is a commissioning tool that allows you to view C-Bus messages on the selected network. It will identify the Application, group address, Time, Date, Originating Unit and Event of each message and display it in a list.
Applications	The Applications node will display, add, delete and edit existing applications. It can be expanded out so that you can view each application address in the Navigation tree. Toolkit will automatically add the more commonly used application addresses.
Specific application	These are a series of nodes, that display the actual application address what you want to view.
Group	The Group node allows you to add, delete and edit the Tag of a group address on the selected Application. Group addresses can also be toggled ON and OFF. Levels can also be added from this node.
Level	The Level node allows you to edit and delete the Levels created for the selected group address.
Units	The Units node allows the C-Bus units to be programmed.
Topology	The Topology node will provide an accurate network layout, showing how all C-Bus networks for the selected project are connected. The Topology of the C-Bus networks is displayed in the Programming window.

Table 20 - Navigation tree nodes

The Toolbar

The toolbar in Toolkit provides access to various different buttons to manage, program and commission a
C-Bus project. The type of buttons that are displayed on the toolbar are dependent on the node that is selected by the Navigation tree.

NOTES: Some buttons on the toolbar will appear greyed out and will require certain conditions to be met to allow it to be selected.

Some buttons may also have a small arrow to the right hand side, which can be pressed to further access other related programming functions.

The following tables list the buttons on the toolbar, depending on which node of the Navigation tree is selected.

Toolbar Button	Button Description
Add Project	Creates a new C-Bus project inside Toolkit
Find C-Bus Networks	Attempt to find, open and scan a C-Bus network
Close All Networks	Closes any C-Bus networks that are currently running
Refresh	Initialises the Toolkit Navigation tree

Table 21 - Project Repository toolbar buttons

Toolbar Button	Button Description
Rename Project	Allows you to change the name of the selected C-Bus project.
Copy Project	Duplicates the selected C-Bus project.
Delete Project	Deletes the selected C-Bus project from the Toolkit software.
Open All Networks	Opens each C-Bus network in the selected project.
Close All Networks	Closes each C-Bus network in the selected project.
Backup Project	Creates a backup of the selected Toolkit project.
Document Project	Creates a HTML report of C-Bus programming of the selected project.
Add Network	Adds a C-Bus network to the selected C-Bus project.
Delete Network	Deletes the selected C-Bus network from the selected C-Bus project.
Edit Network	Allows the modification of the C-Bus network properties for the selected C-Bus network.
Open Network	Opens and connects to the selected C-Bus network.
Close Network	Closes and disconnects from the selected C-Bus network.
Copy Tags	Allows group address tags to be copied from another C-Bus network, to the selected C-Bus network.
Readdress	Allows the selected network address to be changed.
DLT Labels	Allows the programming of DLT Labels.
Set Project All	Uploads the Toolkit project name to all C-Bus units on the selected network.

Table 22 - C-Bus Project toolbar buttons

Toolbar Button	Button Description
Delete Network	Deletes the selected C-Bus network from the selected C-Bus project.
Edit Network	Allows the modification of the C-Bus network properties for the selected C-Bus network.
Open Network	Opens and connects to the selected C-Bus network.
Close Network	Closes and disconnects from the selected C-Bus network.
Copy Tags	Allow group address tags to be copied from another C-Bus network, to the selected C-Bus network.
Readdress	Allows the selected Network Address to be changed.
DLT Labels	Allows the programming of DLT Labels.
Set Project All	Downloads the Toolkit project name to all C-Bus units on the selected network.

Table 23 - C-Bus Network toolbar buttons

Toolbar Button	Button Description
Clear Log	Deletes the contents of the application log.
Pause / Resume	Pauses and runs the application log.
Filter	Allows you to restrict the information that the application log is displaying.
Save Log	Generates and saves a text file containing information from the application log.
Edit Application	Allow the modification of the selected application name.
Edit Group	Allows the modification of the selected group address tag.
Edit Unit	Opens the graphical user interface, to program the selected C-Bus unit.

Table 24 - Application Log toolbar buttons

Toolbar Button	Button Description
Add Application	Allows the creation of a new application address.
Edit Application	Allows the modification of the selected application name.
Delete Application	Deletes the selected application address.

Table 25 - Applications toolbar buttons

Toolbar Button	Button Description
Edit Application	Allows the modification of the selected Application Name.
Delete Application	Deletes the selected application address.
Add Group	Adds a group address to the selected application address.
Add Multiple Groups	Opens a form that allows multiple group addresses to be created on the selected application address.
Edit Group	Allows the modification of the selected group address tag.
Delete Group	Deletes the selected group address.
Set Group On	Sets the selected group address to 100% (ON).
Ramp	Ramps the selected group address to a specified level.
Set Group Off	Sets the selected group address to 0% (OFF).
Flash Group	Continually toggles the group address On and Off to help identify where the selected group address is being used.
Modify Last Unit To Set	Allows the editing of the last unit to use the selected group address.
DLT Labels	Allows the programming of DLT Labels for the selected group address.

Table 26 - Specific Application toolbar buttons

Toolbar Button	Button Description
Edit Group	Allows the modification of the selected group address tag.
Delete Group	Deletes the selected group address.
Set Group On	Sets the selected group address to 100% (ON).
Ramp	Ramps the selected group address to a specified level.
Set Group Off	Sets the selected group address to 0% (OFF).
Flash Group	Continually toggles the group address On and Off to help identify where the selected group address is being used.
Modify Last Unit To Set	Allows the editing of the last unit to use the selected group address.
DLT Labels	Allows the programming of DLT Labels for the selected group address.
Add Levels	Creates a level for the selected group address.
Edit Level	Allows the modification of a description of a level, for the selected group address.
Delete Level	Deletes the selected Level of the group address.
Set Level	Sets the group address to the selected Level.

Table 27 - Group toolbar buttons

Toolbar Button	Button Description
Delete Level	Deletes the selected level of the group address.
Edit Level	Allows the modification of a description of a level, for the selected group address.
Set Level	Sets the group address to the selected level.

Table 28 - Level toolbar buttons

Toolbar Button	Button Description
Add Unit	Add a C-Bus unit to the database of the selected C-Bus network.
Edit Unit	Opens the graphical user interface for the selected C-Bus unit.
Delete Unit	Deletes the selected C-Bus unit from the database.
Convert Units	Allows the conversion of a C-Bus unit in the database to a similar unit type.
Copy Unit	Duplicates the selected C-Bus unit, and add it to the database.
Readdress	Changes the unit address of the selected C-Bus unit.
Readdress To Match Network	Changes the unit address of the selected unit in the database, to match an identical unit on the network.
Get Serials	Obtains the serial numbers from the physical C-Bus unit, and add it to the database.
Transfer To Network	Transfers the programming of the selected C-Bus unit to the C-Bus network.
All To Network	Transfers all of the programming from the database to the C-Bus network.
Global Programming	Allows network wide programming options for various parameters.
Document Database	Creates a *.csv file to show how the C-Bus network is programmed.
Reinstall	Transfers the configuration data from the selected C-Bus unit, to an identical unit at Unit Address 255 on the physical network.

Table 29 - Units toolbar buttons, for database programming

Toolbar Button	Button Description
Scan Network	Scans the selected C-Bus network.
Scan New	Scans a connected network to check if a new unit has been added
Edit Unit	Opens the graphical user interface for the selected C-Bus unit.
Readdress	Changes the unit address of the selected C-Bus unit on the network.
Serial Number Readdress	Compares the serial numbers in the C-Bus units, and ensure that the unit addressing in the network and database is identical.
Readdress To Match Database	Changes the unit address of the selected C-Bus unit to match the unit's unit address in the database.
Add/Transfer To DB	Transfers the selected unit on the network into the database.
All To Database	Transfers all network information into the database.
Advanced Transfer	Allows more flexibility when transferring a C-Bus network to the database.
Unravel	Resolves any unit address conflicts on the network.
Ping	Sends a message to the C-Bus network to verify that a scanned unit is still operational.
Make Network	Creates a new C-Bus network via a C-Bus Network Bridge.

Table 30 - Units toolbar buttons, for network programming

Toolbar Button	Button Description
Copy Image	Copies the topology so it can be pasted into a document.
Print	Prints the network topology map.
Near Side	Opens the graphical user interface for the near side of the selected network bridge.
Far Side	Opens the graphical user interface for the far side of the selected Network Bridge.
Navigate To Network	Navigates to the Units node for the selected C-Bus network.

Table 31 - Topology toolbar buttons

The Programming Window

The Programming window is the main programming workspace for C-Bus Toolkit. Depending on which node of the Navigation tree is selected, different information and programming options will be displayed in the Programming window.

NOTE: The Programming window will also display different information on the screen, if C-Bus Toolkit is online and connected to a C-Bus network.

Installing USB Drivers

USB Drivers for all C-Bus units are automatically loaded onto your PC, during the installation of C-Bus Toolkit. While installing Toolkit, the form below will appear.

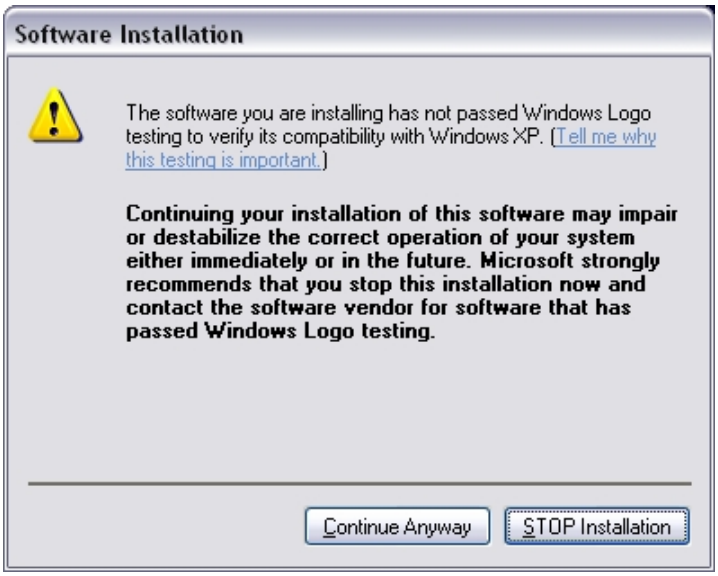


Figure 45 - Software installation form

Please ensure you select the Continue Anyway button, to allow the USB drivers to be installed and used with the Toolkit software.

Creating a Project

To create a new C-Bus project in Toolkit, follow the steps below.

1) Open C-Bus Toolkit and ensure the Project Repository node (labelled C-Bus Projects) of the Navigation tree is selected.
2) Click on the Add Project button on the toolbar.
3) The image in Figure will appear. Enter the name for the Toolkit project and press the OK button.

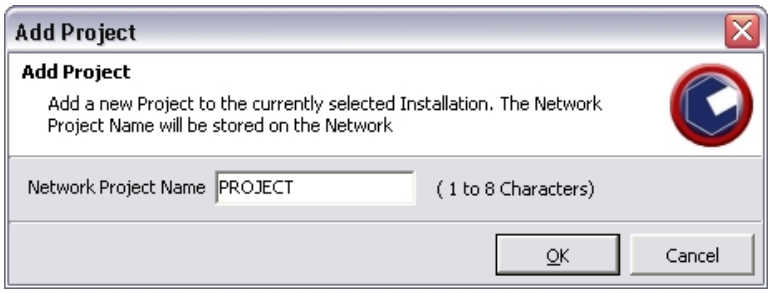


Figure 46 - The Add Project form

4) You will then be asked to confirm if you wish to add a C-Bus network to the new project. Click on the yes button to add a C-Bus network to the project.

Figure 47 - Confirming the addition of a C-Bus network to a Toolkit projects

5) An Add Network form will then appear as shown below. Ensure that you:

- Name the C-Bus network.
- Select the type of interface that Toolkit will be connecting to.
- Select the physical address of the interface that Toolkit will be connecting to.

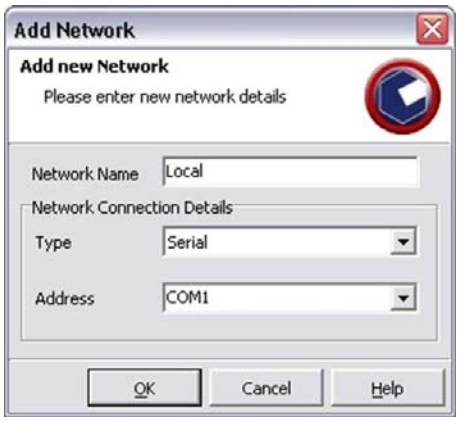


Figure 48 - Add Network form

6) Press the OK button to continue. You will now see that a new project with the given project name will appear in the Navigation window. This project will also include a single C-Bus network.

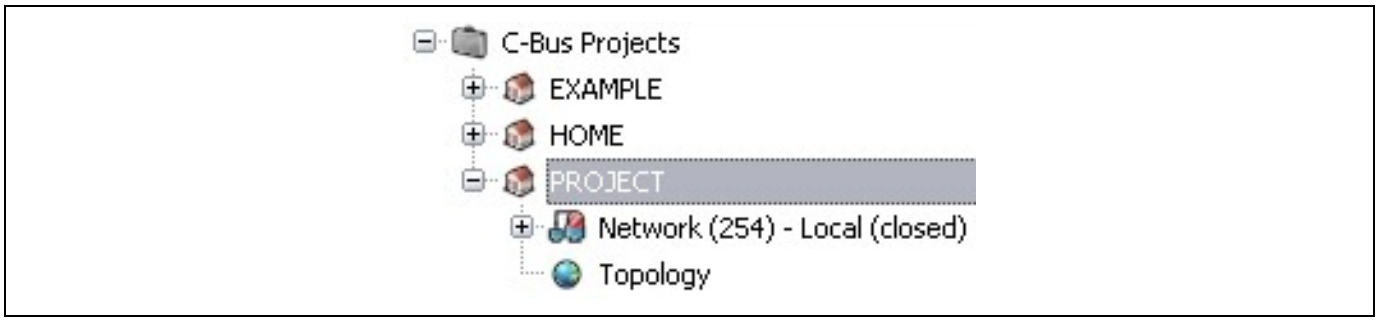


Figure 49 - The new C-Bus project in the Navigation tree

Editing a Network

To edit an existing C-Bus network in a Toolkit project, follow the steps below.

1) Navigate to the Navigation tree and select which C-Bus project has the C-Bus network you wish to edit.
2) In the Navigation tree, expand out the selected C-Bus project and click on the C-Bus network you wish to edit.
3) Navigate to the toolbar and click on the Edit Network button.
4) The Edit Network form will then be displayed (this is identical to the Add Network form). You may then modify the:
   - Name the C-Bus network.
   - Type of interface that Toolkit will be connecting to.
   - Physical address of the interface that Toolkit will be connecting to.

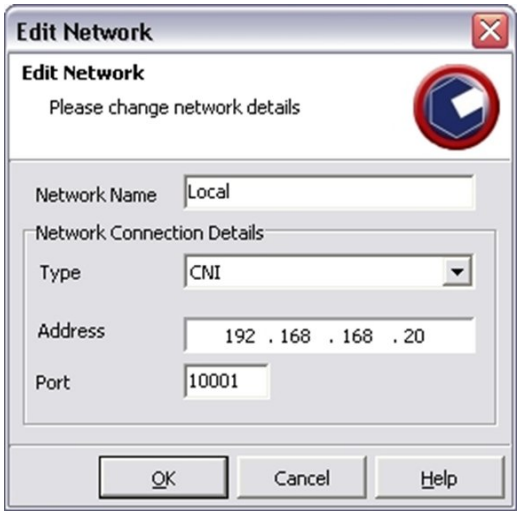


Figure 50 - Edit Network form

5) Press the OK button to continue. The settings and details of the selected C-Bus network have now changed.

Creating Group Addresses

C-Bus group addresses may be created a number of different ways. They can be created:

- prior to programming through planning the C-Bus project
- as needed when programming C-Bus units via the graphical user interface (GUI).

The best way to create C-Bus group addresses is to add all of the group addresses that are needed to program the C-Bus network. Any C-Bus group addresses that need to be added, can be created via the same process or through the GUI.

To create C-Bus group addresses, follow the steps below.

1) Navigate to the Navigation tree and select the C-Bus project that you wish to add group addresses to.
2) In the Navigation tree, expand out the selected C-Bus project and click on the C-Bus network you wish to add group addresses to.
3) In the Navigation tree, select and expand out the selected Applications node of the C-Bus network you wish to add group addresses to.
4) Select the Lighting Application node in the Navigation tree.
5) Navigate to the toolbar and click on the small arrow to the right hand side of the Add Group button. This will display another button called Add Multiple Groups. Click on the Add Multiple Groups button and the form below will appear.

Figure 51 - Add Multiple Groups form

6) Click on the Add button, until you have created enough group addresses for the selected C-Bus network.

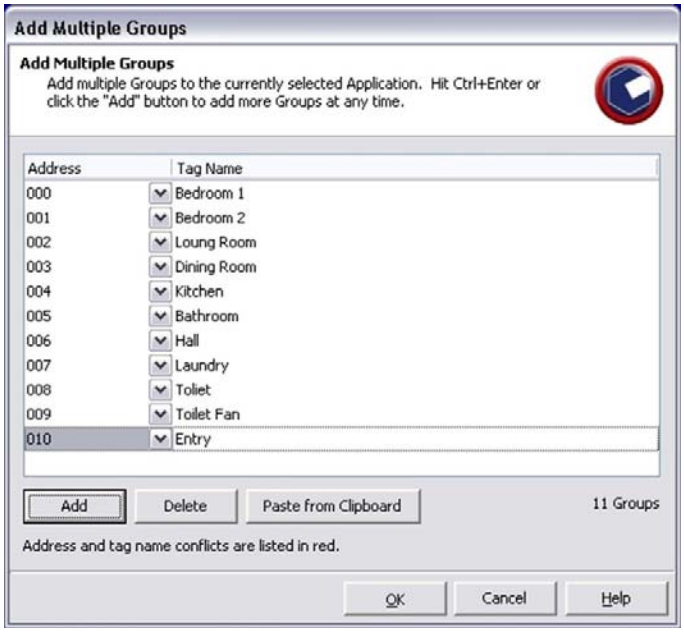


Figure 53 - Editing group address tag names

7) Click the OK button to complete creating group addresses. These group addresses will now be visible when programming C-Bus units.

Add Units to Database

Adding C-Bus units to a database is purely a theoretical exercise, however an accurate and fully programmed database can be transferred to the C-Bus network. This allows:

- a reduced amount of time programming on site
- the C-Bus network characteristics and operating parameters to be calculated
- an accurate project backup to be created.

There are two common ways to add C-Bus units to a database:

- adding units manually
- adding units with the Bar Code Scanner

Adding Units Manually

To add a C-Bus unit to the Database of a C-Bus network, follow these steps:

1) Navigate to the Navigation tree and select the C-Bus project that you wish to add a C-Bus unit to (in its database).

2) In the Navigation tree, expand out the selected C-Bus project and click on the C-Bus network you wish to add a C-Bus unit to. Expand this node of the navigation tree.

3) Select the units node in the Navigation tree.

4) Navigate to the toolbar and click on the 'Add Unit' button, this will open the Unit Selection form as shown below.

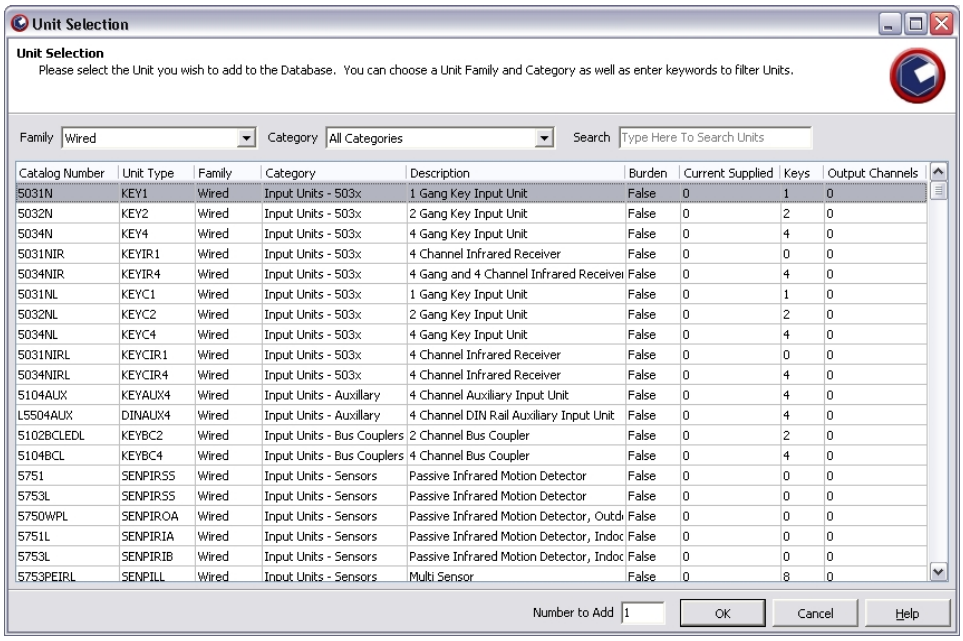


Figure 54 - The Unit Selection form

5) In the Search field, type some information about the C-Bus unit that you wish to add to the database. This is dynamic predictive text, which will search:

- • catalogue numbers e.g. "L5512RVF"
- • unit types e.g. "KEY4"
- • unit descriptions e.g. "8 Channel Dimmer".

6) Once you have searched for the desired C-Bus unit, click on it and press the OK button. This will open the Unit Identify form as shown below.

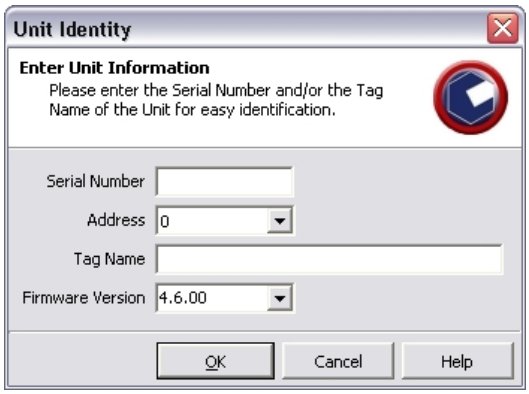


Figure 55 – The Unit Identity form

7) It is not necessary to fill in all of the fields on the Unit Identify form (you may decide to press the OK button at this point). However this form allows you to specify and select the:
   - serial number of the C-Bus unit (which can be found on the box)
   - unit address that you want this C-Bus unit to be
   - a tag name to help identify the location of the C-Bus unit e.g. “DLT At Front Door”
   - firmware version of the C-Bus unit, which is always the latest firmware by default.
8) Press the OK button to add the unit to the database.
9) Repeat this process for all of the C-Bus units on that specific C-Bus network and the units in the database will be populated.
10) Once completed the Programming window of Toolkit will display all of the C-Bus units that you have added to the Toolkit database, as shown below.

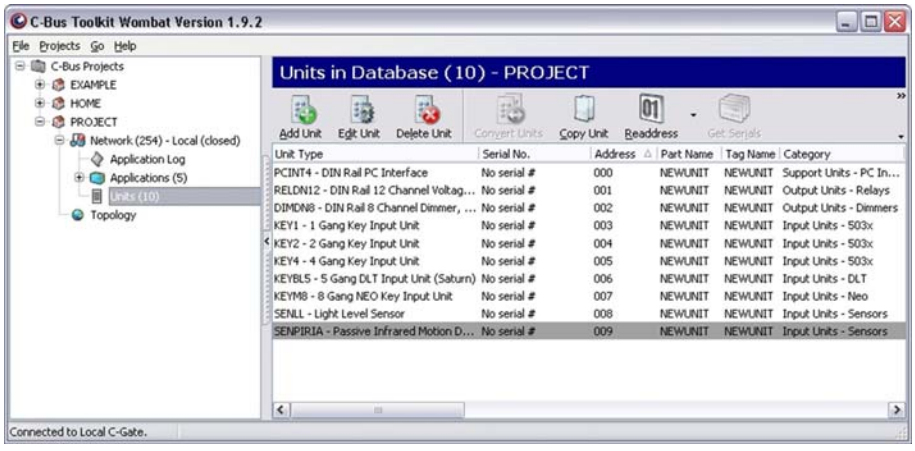


Figure 56- C-Bus units in the Database Programming window

Adding Units With The Bar Code Scanner

By using a C-Bus Bar Code Scanner (5100BCS), you can easily add C-Bus units to the database. This is a more efficient way to add units to the database as it will:

- add the unit to the database, without the need to search for it
- automatically add the serial number to the unit:

NOTE: This will significantly improve the process of aligning the physical C-Bus network to match the database, as the Match Serials button can be used to Auto Align all C-Bus units.

To add C-Bus units to the database by using the C-Bus Bar Code Scanner, follow the steps below:

1) Navigate to the Navigation tree and select the C-Bus project that you wish to add a C-Bus unit to (in its database).
2) In the Navigation tree, expand out the selected C-Bus project and click on the C-Bus network you wish to add a C-Bus unit to. Expand this node of the navigation tree.
3) Select the units node in the Navigation tree.
4) Press the F10 button on the PC keyboard, and the following notification will appear.

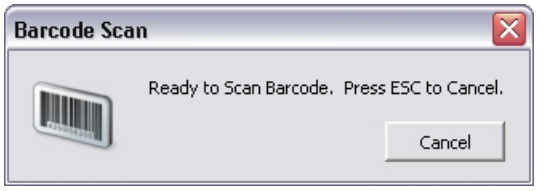


Figure 57 - Barcode Scan notification

5) Take the Barcode Scanner, and scan the Barcode of each C-Bus unit. The Barcode can be found on a sticker on the side of the Box. This will automatically retrieve the:

- serial number
- unit type
- catalogue code
- next available unit address

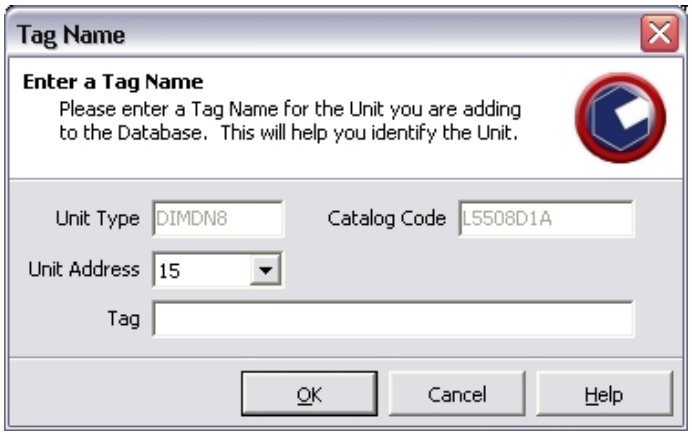


Figure 58 - Adding a C-Bus unit by using the Barcode Scanner

6) Press the OK button, to add the unit to the database. Repeat this process for all of the C-Bus units.

Opening a C-Bus Project/Network

Opening a C-Bus project or network allows the C-Bus Toolkit software to physically connect to the PC Interface. This will allow the:

- physical C-Bus network to be scanned
- C-Bus units to be programmed.

Opening a C-Bus project or network is dependent on which node of the Navigation tree is selected:

- If the C-Bus Project node of the Navigation tree is selected, by pressing the Open All Networks button on the toolbar, each C-Bus network in the selected project will open.
- If the C-Bus Network node of the Navigation tree is selected, by pressing the Open Network button on the toolbar, the selected C-Bus network will open.

NOTE: Before opening a C-Bus project or network, you must ensure that the C-Bus network has the correct network connection details e.g. that this project has a PC Interface at COM1 as its connection. This can be checked and modified (if needed) by editing the network settings.

Once a C-Bus project or network has been opened successfully you will see that the:

- project is given a description of “Open Networks”
- network is given a description of “Running”.

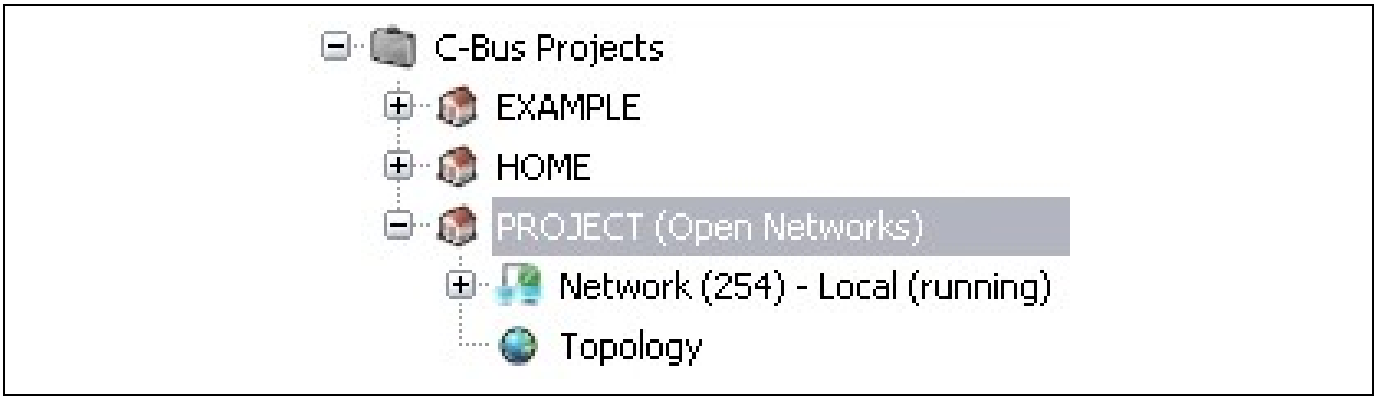


Figure 59 – An open C-Bus project

Closing a C-Bus Project / Network

Closing a C-Bus project or network will disconnect the Toolkit software from the PC Interface used by the running project.

Closing a C-Bus project or network is dependent on which node of the Navigation tree is selected:

- If the C-Bus Project node of the Navigation tree is selected, by pressing the Close All Networks button on the toolbar, each C-Bus network in the selected project will close.
- If the C-Bus Network node of the Navigation tree is selected, by pressing the Close Network button on the toolbar, the selected C-Bus network will close.

Once a C-Bus project or network has been closed successfully you will see that the network node in the Navigation tree is given a description of “Closed”.

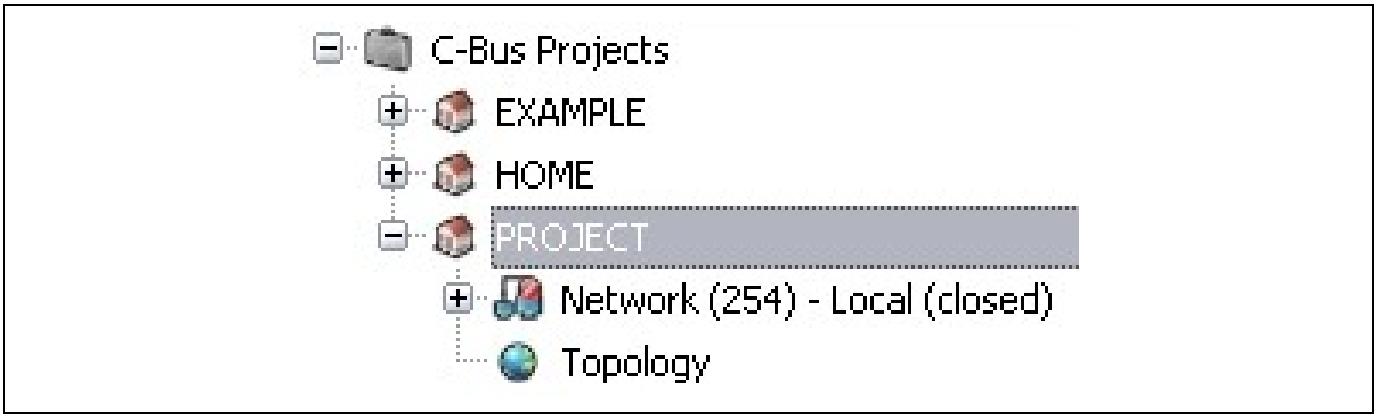


Figure 60 - A closed C-bus project

Scanning a Network

Scanning a C-Bus network is the process that must be carried out in order to begin programming C-Bus units.

To scan a C-Bus network, follow the steps below:

1) Ensure that the PC is physically connected to the PC Interface.
2) Ensure that the selected C-Bus Project has the correct Network Connection Details (which can be viewed and modified if needed, by editing the network).
3) Ensure that the Project is open and running.
4) Once the project is running, navigate to the Units node of the open project. You will find that the programming window is split into two sections:
   - units in database
   - units on network.

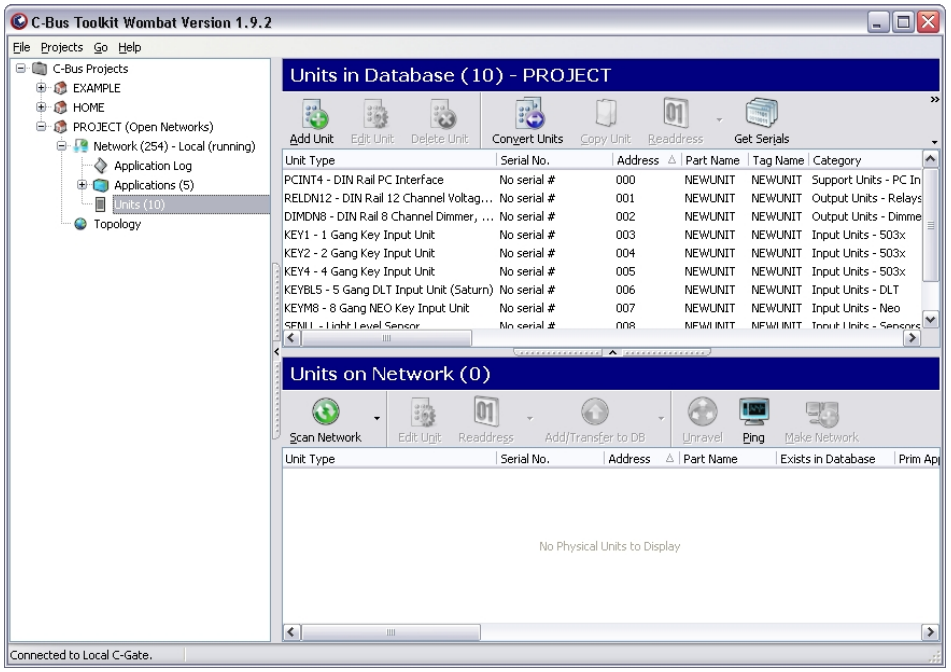


Figure 61 - Database and network shown when the project is running

5) Navigate to the toolbar for the Units On Network, and click on the 'Scan Network' button. A progress bar will appear, indicating the different stages involved in a scan. The Network Scan will retrieve real time information such as:

- unit type
- serial number
- unit address
- part name
- • various other programming parameters.

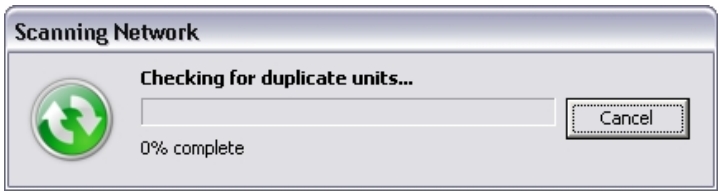


Figure 62 - The Scanning Network progress bar

6) Once the scan has completed, you will see the all the C-Bus units on the network.

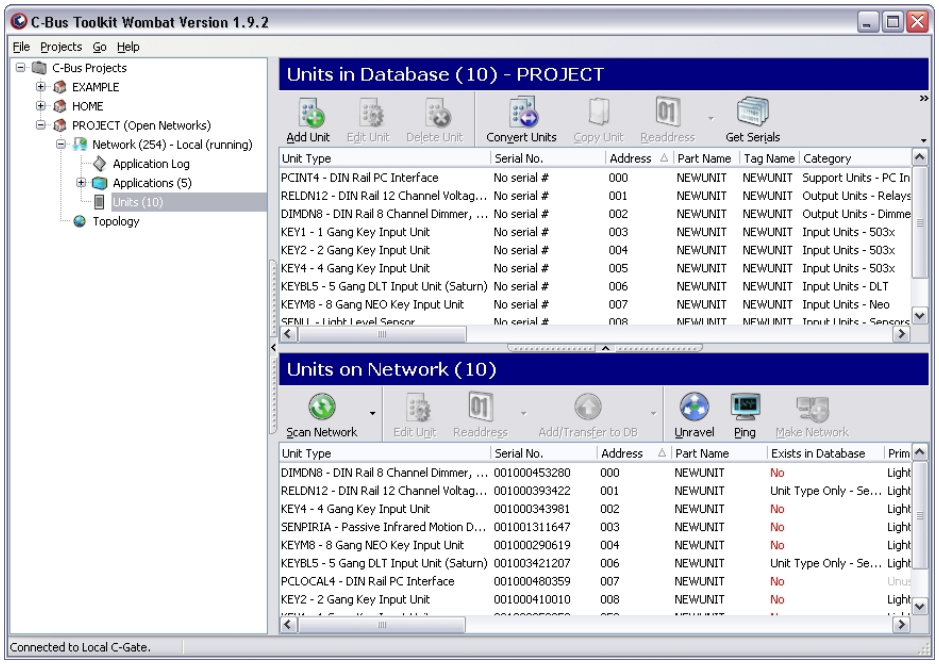


Figure 63 - A fully scanned C-Bus network

A C-Bus network cannot be scanned if there is:

- no C-Bus voltage
- no C-Bus clock
- insufficient or excessive network impedance.

Readdressing C-Bus Units

Typically after scanning a C-Bus Network for the first time, you will notice that the unit addresses in the database does not match the unit addresses on the network.

Readdressing C-Bus units is used to align the unit addresses of C-Bus units in the network and database. This is particularly important, as it is a contributing factor that will allow the full database to be downloaded into the network.

To transfer the database to the network, there are two parameters that must be identical between the network and database:

- the unit address
- the unit type.

An identical network and database will ensure that the correct programming information is downloaded to the correct unit on the C-Bus network.

There are two common methods used to align the unit addresses between the network and database:

- manually readdressing each C-Bus unit to match the database
- automatically readdress to match by serial numbers.

Readdress To Match Database

To readdress the unit address of a C-Bus unit on the network to match the database, follow the steps below:

1) Scan the C-Bus network.
2) Select a single C-Bus unit in the network.
3) Navigate to the Units on Network toolbar in the Programming window, and click on the small arrow to the right hand side of the Readdress button. This will display more buttons related to readdressing C-Bus units. Click on the Readdress to Match Database button and the form below will appear.

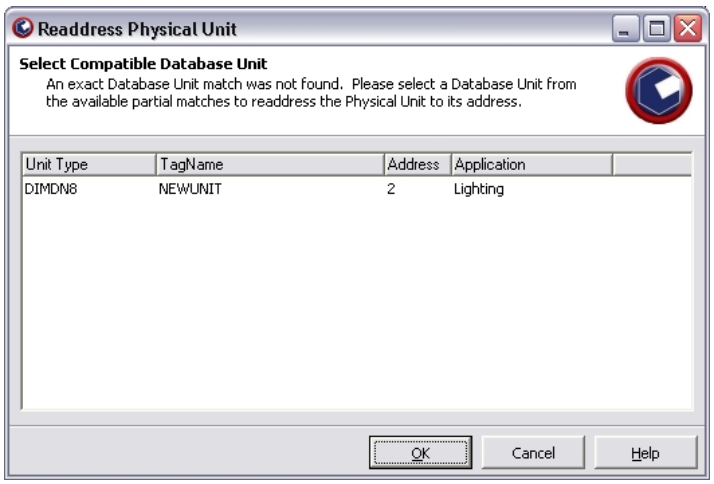


Figure 64 - Readdress Physical Unit form

4) Click on the OK button.

5) If Toolkit detects that the required unit address is occupied by another C-Bus unit, you will be required to confirm that you want Toolkit to move the C-Bus unit which is occupying the desired unit address.

Figure 65 - Confirming the readdressing of a C-Bus unit

6) You will now find that the unit address for the selected C-Bus unit is identical in the network and database.

7) Repeat this process for all C-Bus units on the network, until the entire network has the same unit addresses as the database.

Serial Number Readdress

A much quicker way to readdress the network to match the database, is to use the Serial Number Readdress function. This can only be used if you:

- manually type the serial number into each unit in the database, or
- use the C-Bus Barcode Scanner to add C-Bus units to the Database.

Once you have a database fully populated with C-Bus units with serial numbers, you may readdress the entire network in a much quicker process, as listed below:

1) Scan the C-Bus network.
2) Navigate to the Units On Network toolbar in the Programming window, and click on the small arrow to the right hand side of the Readdress button. This will display more buttons related to readdressing C-Bus units. Click on the Serial Number Readdress button and the form below will appear.

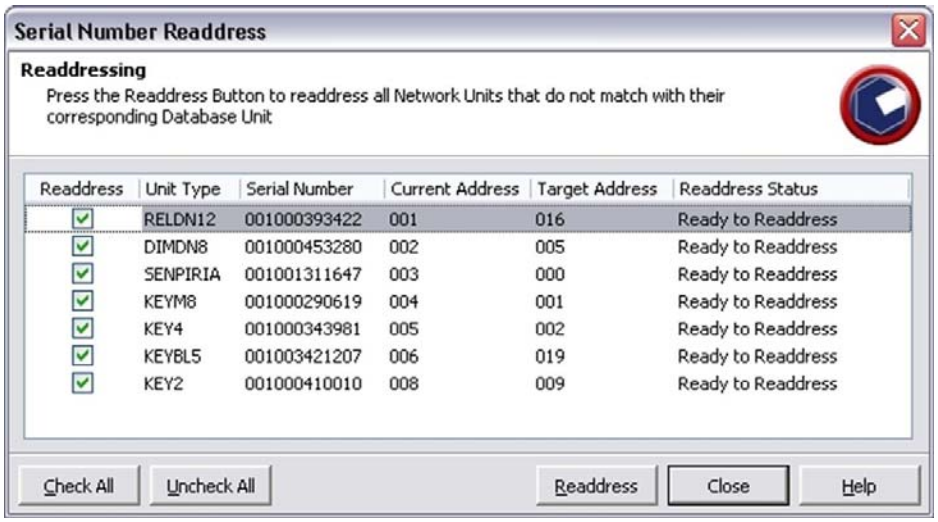


Figure 66 - Readdressing C-Bus units to match by serial number

3) Click on the Readdress button. Once completed an information form will pop up to indicate that the readdressing process is complete. Press the OK button.
4) Press the Close button to shutdown the Serial Number Readdress form.
5) You will now find that the unit addresses for all C-Bus units are identical in the network and database.

Transferring Database to Network

Once all of the C-Bus units in the database have been programmed, the Toolkit software can transfer the database programming information into the physical C-Bus network.

NOTE: This is not the only way to program C-Bus units, however this programming method requires less time programming on site. This is achieved by doing the majority of the programming in the comfort of your office.

To transfer the Database to the Network, follow the steps below:

1) Scan the C-Bus network.
2) Ensure that all of the unit addresses and unit types are identical in both the network and database. E.g. That at Unit Address 003 in the network and database, there is a DIN Rail 12 Channel Relay etc.
3) Navigate to the Units In Database toolbar in the Programming window, and click on the small arrow to the right hand side of the Transfer to Network button. This will display more buttons related to transferring programming to C-Bus units. Click on the All to Network button and the form below will appear, and the transfer process will begin.

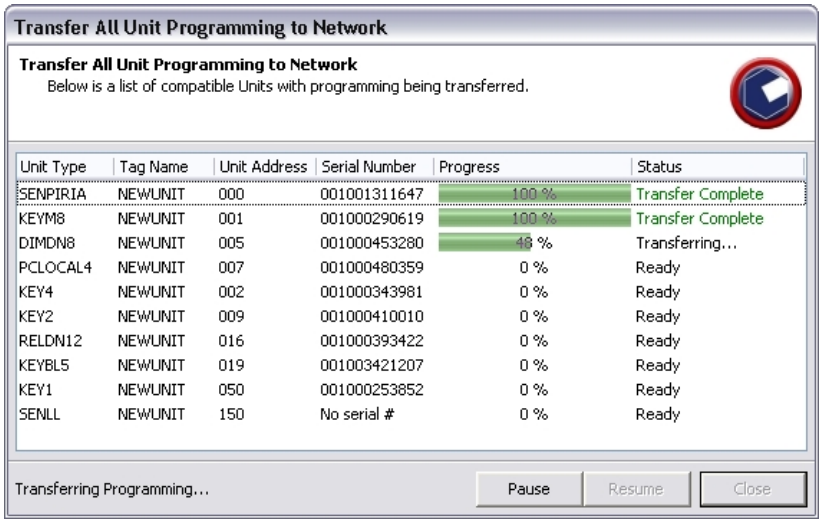


Figure 67 - Transfer All Unit Programming to Network form

4) Once the transfer process has completed, click on the Close button to close the Transfer All Unit Programming to Network form.
5) The contents of the database will now have been transferred into all the C-Bus units on the network.
6) Test and commission the C-Bus network to ensure that it is working as expected.

Application Log

The application log is a useful commissioning and diagnostic tool. It allows the logging of C-Bus traffic on the selected C-Bus network. It will display information such as the:

- application address of a C-Bus message
- group address of a C-Bus message
- unit address that issues the C-Bus message
- time and date that the C-Bus message was sent
- physical action of the group address.

To use the application log, follow the steps below:

1) Open a C-Bus network.
2) Scan the selected C-Bus network.
3) Navigate to the Application Log node in the Navigation tree.
4) You will now see real time C-Bus network traffic, as shown below in the Programming window.

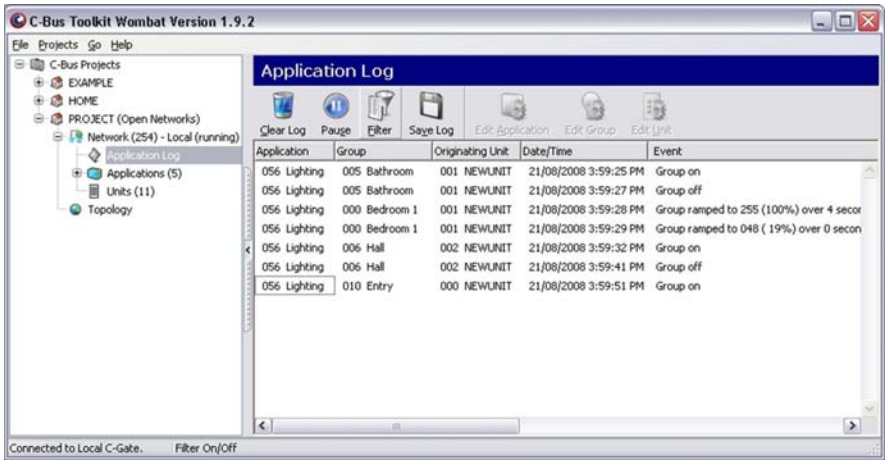


Figure 68 - The application log

Programming C-Bus Units

The following chapters are designed to identify how to program various C-Bus units from the graphical user interface (GUI).

While programming, remember that the fundamental programming concept of C-Bus, is to make an association between a button on an input unit, and a channel of an output unit. As long as they have the same association (group address), they will communicate with each other.

On each GUI, you will commonly find the following buttons in the table below.

Button	Function
Drop Down List	This button ( ) will allow you to select a previously created group addresses.
Add New Group Address	This button ( ) will allow create an new group addresses.
Edit This Group	This button ( ) will allow you to edit the Tag Name for the selected group addresses.
OK	This button will save all current programming (for the selected unit) and close the GUI.
Cancel	This button will close the selected GUI without saving any changes.
Apply	This button will save all current programming (for the selected unit) and leave the GUI opened.
Help	This button will open the Help file for the selected unit.
Reset Unit	This button will reset the GUI to its default.
Advanced	This button will display and allow the manipulation of advanced programming parameters.

Table 1 - Common buttons on GUIs

DIN Rail Relays

To begin programming a DIN Rail relay, double click on the DIN Rail relay in the Database or Network section of the Programming window. This will open the GUI of the relay.

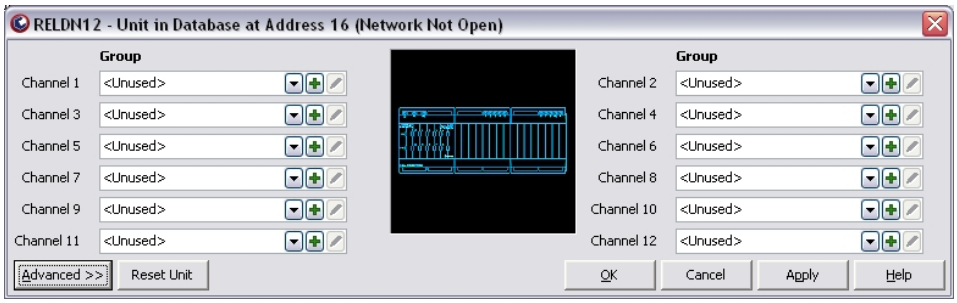


Figure 69 - DIN rail relay GUI

To assign a group address to a channel of the relay, navigate to the desired channel, and:

- select a group address from the drop down box, or
- create a new group address.

Repeat this for all required channels. If you wish to program or edit any advanced parameters click on the Advanced button. Once all programming has been completed, press the OK or Apply button.

Unit Identification Tab

The Unit Identification tab will display additional programming information inside of the relay's GUI as shown below.

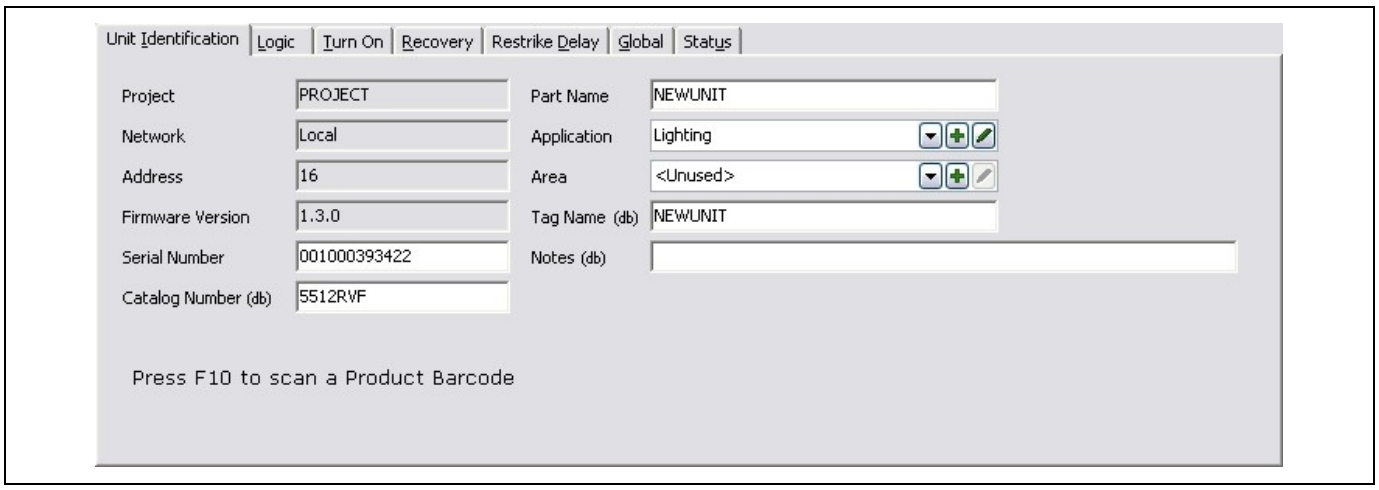


Figure 70 – The Unit Identification tab of a DIN rail relay

The Unit Identification tab will display the:

- name of the Toolkit Project
- C-Bus network that the unit is on
- unit address of the C-Bus device

- firmware version of the C-Bus device
- serial number of the unit
- catalogue number of the unit.

The table below highlights the more important parameters in the Unit Identification tab.

Parameter	Description
Part Name	Assigns a name to the C-Bus unit, to help identify its physical location. This is an 8 character name which is physically stored in the relay.
Application	Selects the application address that the relay will operate on.
Area	Specifies an area address for all relay channels to respond to.
Tag Name	Assigns a more meaningful name to the C-Bus relay. This is only stored in the C-Bus database.
Notes	Documents any nonstandard information about the programming, installation or application the C-Bus relay. This is only stored in the C-Bus database.

Table C 1 - Important parameters on the Unit Identification tab

NOTE: The Unit Identification tab is common and identical for almost all C-Bus units.

Logic Tab

The Logic tab is separated into two parts:

- Logic Assignments
- Logic Recovery.

The Logic Assignments allows you to configure 4 low level AND/OR operations on the relay. This means that the control of the selected channels will be dependant on the state (ON or OFF) of the associated logic group.

The Logic Recovery will determine the behavior of the logic group. Logic Recovery will affect the state (ON or OFF) that the Logic Group will return to after power up, allowing the selection of:

- N/C (No Change, which restores to its previous level)
- OFF
- A Level (1% to 99% which is technically ON when using a relay)
- ON.

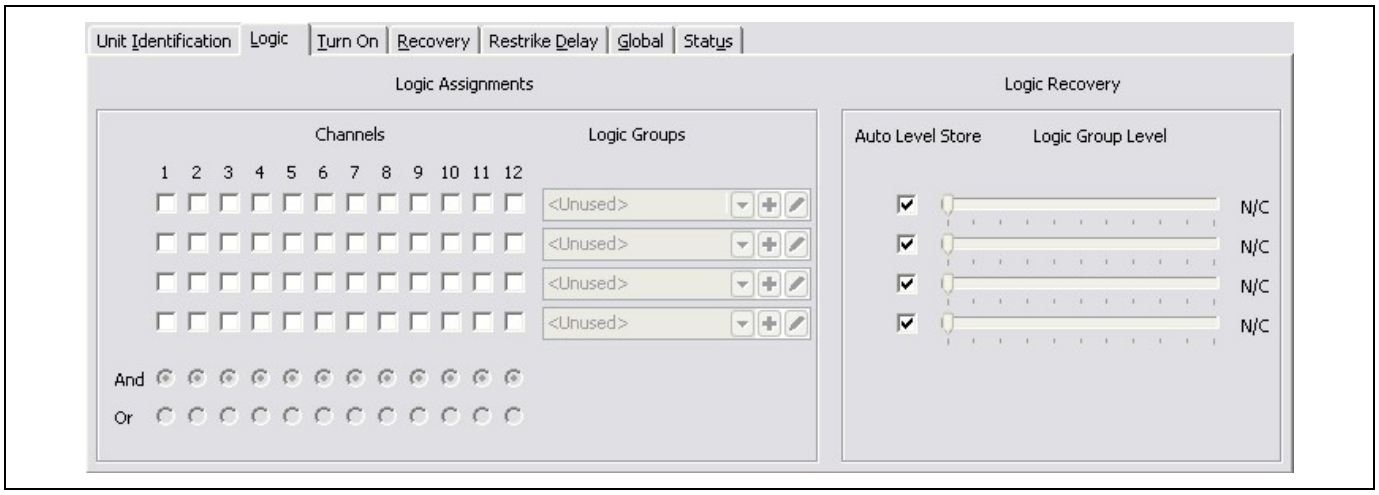


Figure 71 - The Logic tab of a relay

Below is an example of a simple AND Logic Condition. You will see that there are 3 parts to programming the logic condition:

- selecting the relay channels that you want to operate with logic
- selecting a Logic Group from the drop down box
- selecting the logic operator (AND logic) to link the selected relay channel's group address and the logic group.

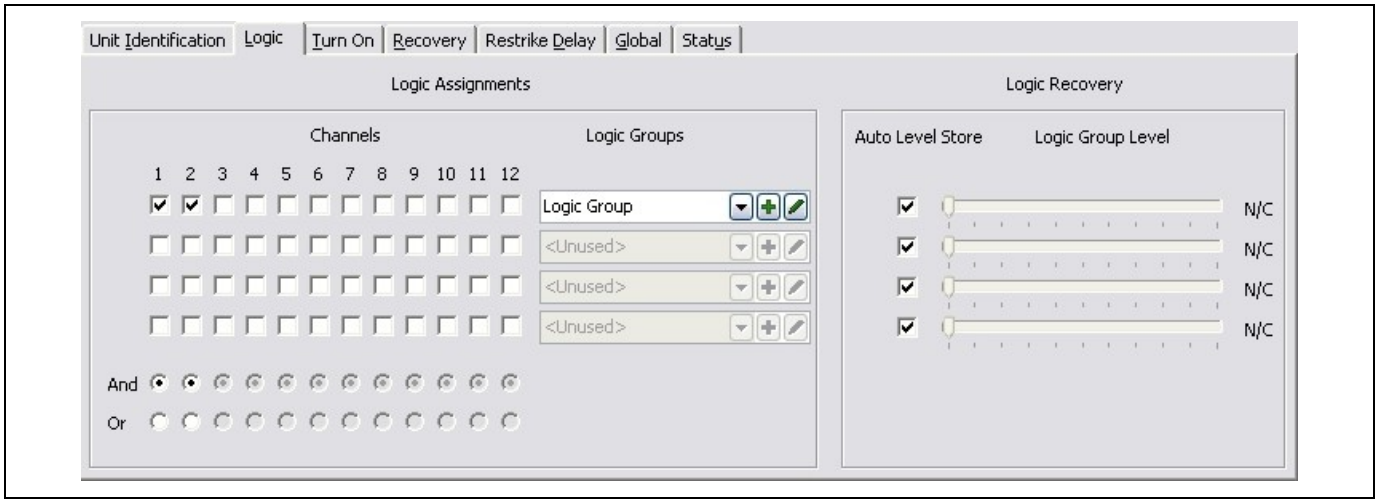


Figure 72 - Using AND logic

The logic assignments in Figure operate as shown in the line diagram below. As you can see the logic group acts as a master switch for the selected relay channels to operate.

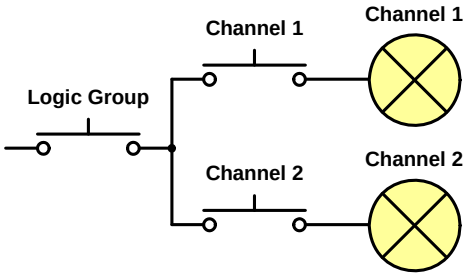


Figure 73 - AND logic line diagram

Below is an example of a simple OR Logic Condition. You will see that there are 3 parts to programming the logic condition:

- selecting the relay channels that you want to operate with logic
- selecting a Logic Group from the drop down box
- selecting the logic operator (OR logic) to link the selected relay channel's group address and the logic group.

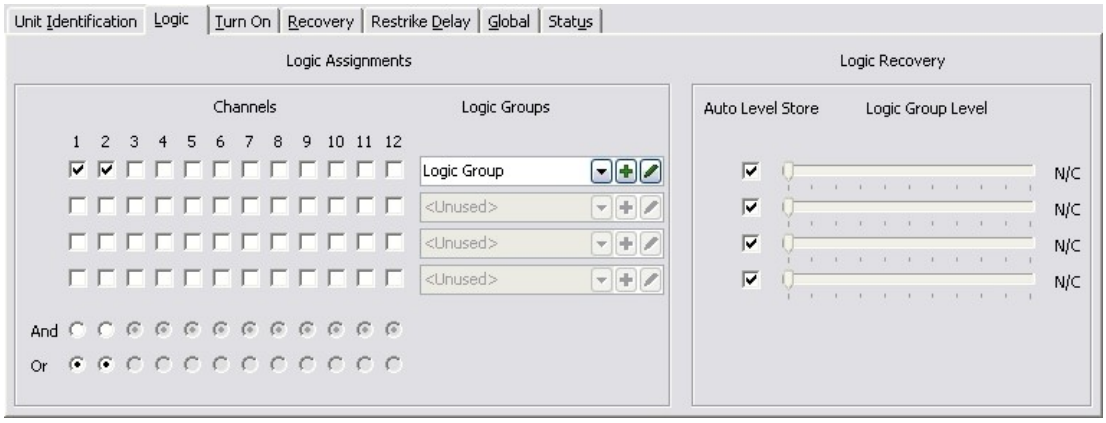


Figure 74 - Using OR logic

The above logic assignments operate as shown in the line diagram below. As you can see the logic group acts as a master bypass switch for the selected relay channels.

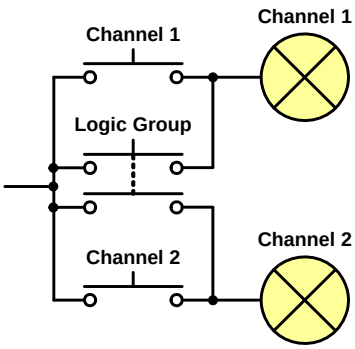


Figure 75 - OR logic line diagram

Turn On Tab

The Turn On tab presents another group of programming functions which affect how and when the channels of the relay will turn ON and OFF.

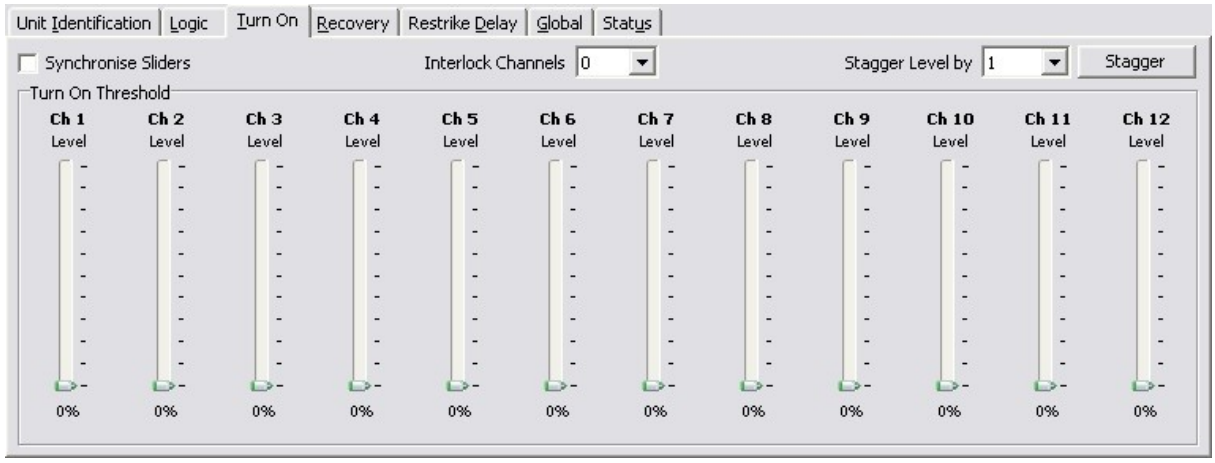


Figure76 - The Turn On tab of a relay

Interlocking is the process of ensuring that only 1 relay channel (in a group of interlocked relay channels) will ever be ON at a time. When channels are interlocked, only the highest numbered interlocked channel will respond to a group address turning ON.

The Interlock Channels parameter allows you to select from a drop down box, how many of the channels on the relay will be interlocked. The table below shows the behaviour of which channel would be ON, if the first three channels of a relay were interlocked.

Channel 1 Group Address	Channel 2 Group Address	Channel 3 Group Address	Which Channel Is ON?
OFF	OFF	OFF	None
ON	OFF	OFF	Channel 1
OFF	ON	OFF	Channel 2
ON	ON	OFF	Channel 2
OFF	OFF	ON	Channel 3
ON	OFF	ON	Channel 3
OFF	ON	ON	Channel 3
ON	ON	ON	Channel 3

Table C 2 - The behaviour of three interlocked relay channels

NOTE: Only one group of interlocked relay channels may be programmed onto a C-Bus relay output unit.

The Turn On Threshold sliders, allows you to set Turn On points for each relay channel. Since a relay is controlled by a group address, the group address can still be dimmed up and down, which controls a relay channel as follows:

- If the group address is OFF, the relay channel is OFF.
- If the group address is not OFF (Level 001 or 1%), the relay channel is ON.

Setting a Turn On Threshold by using the sliders, allows you to specify at what percentage of a group address you want the relay channel to turn on at. The image below has a Turn On Threshold of 40%. You can see that:

- While the group address level is between 1% and 39% the channel is OFF.
- While the group address level is between 40% and 100% the channel is ON.

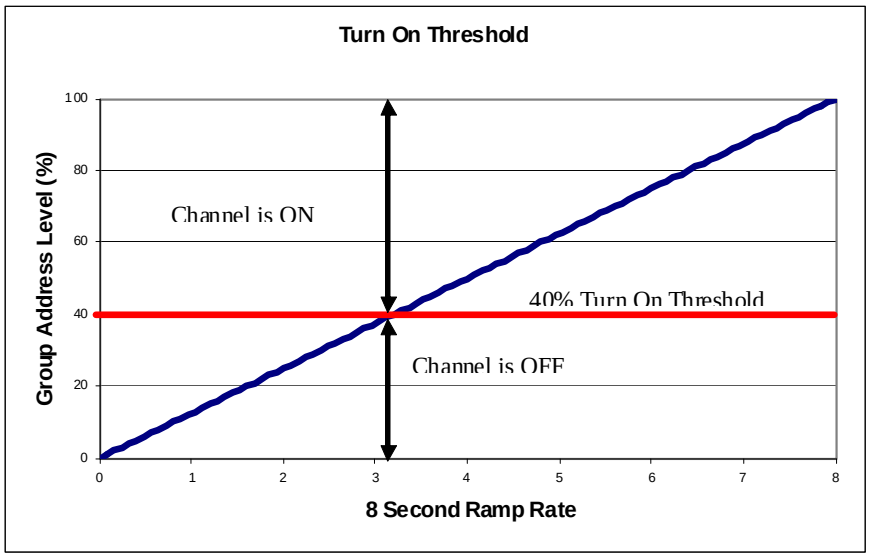


Figure 77 - The state of a group address as it ramps through the Turn On threshold

Recovery Tab

The Recovery tab affects the behaviour of each relay channel on power up.

If the C-Bus relay loses it mains power, the unit will shut down. When mains power is restored to the C-Bus relay, the channels will (by default) restore to the previously known levels as shown in the figure below.

By removing the tick from a relay channel's check box, the following behaviours may be programmed into each individual channel, after mains power is restored:

- Turn ON (100%)
- Turn OFF (0%)
- Set Level using the Slider (1% to 99%).

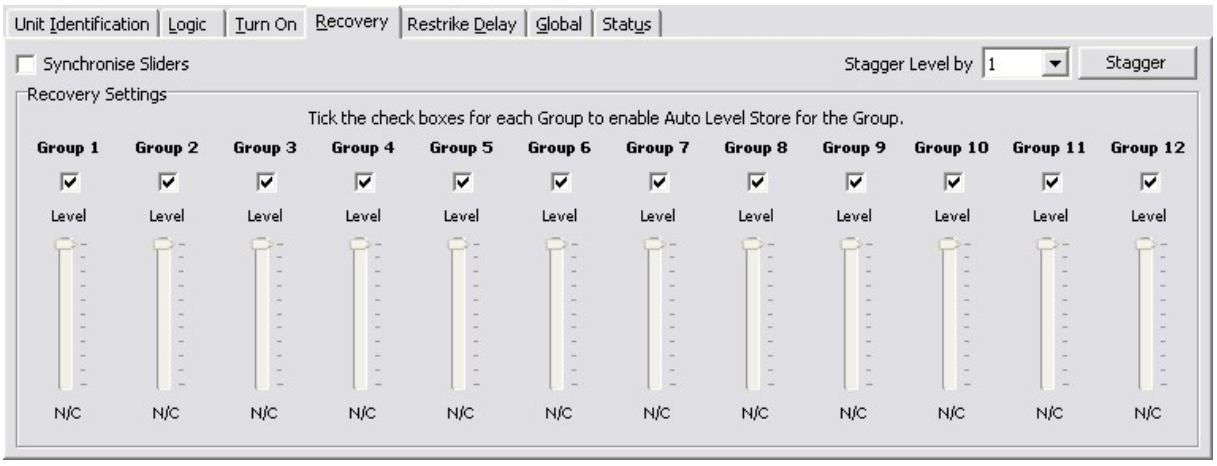


Figure 78 - The Recovery tab of a relay

Restrike Delay Tab

Many lighting devices such as high bay lamps (typically, metal halide or Sodium Vapour lamps) require a minimal period to cool down before being turned on again (restriking).

The Restrike Delay tab provides the means for setting a global restrike delay interval on a channel by channel basis. If you have lamps that require a cooling down period, then you can add a restrike delay by selecting the relevant channels (using the check boxes), and setting the delay interval using the restrike delay.

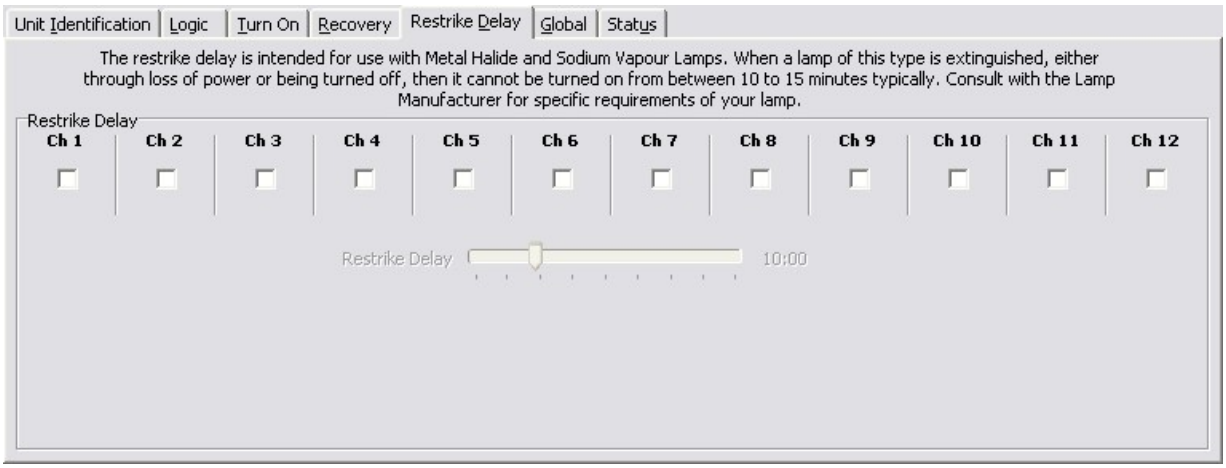


Figure 79 - The Restrike Delay tab of a relay

The image below shows the behaviour of a relay channel with a 10 minute restrike delay programmed into it. You will see that all ON and OFF commands that are sent during the delay period are ignored for that particular channel. Once the 10 minute restrike delay is over, the relay will change to the current state of the group address that its controlled by.

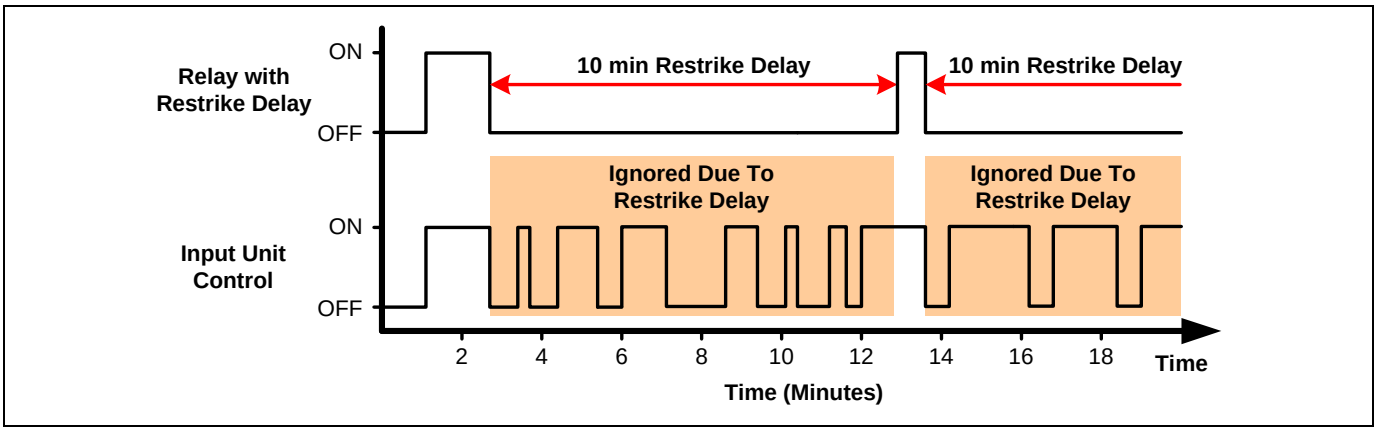


Figure 80 - A relay with a 10 minute restrike delay

Global Tab

The Global tab allows various parameters to be configured for the entire relay unit.

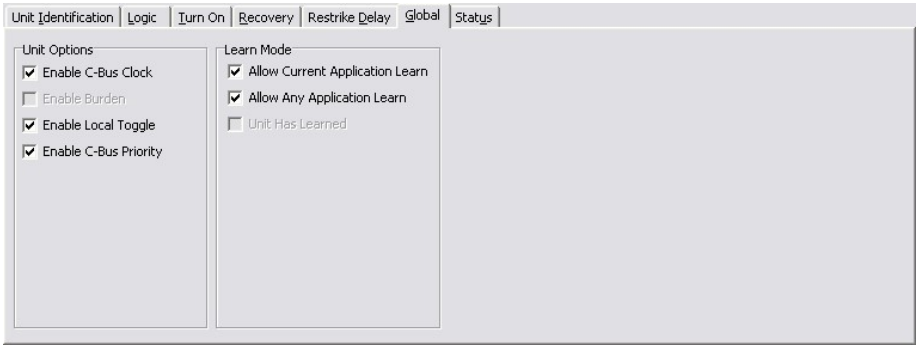


Figure 81 - The Global tab of a relay

The table below identifies the parameters on the Global tab, and their function.

Parameter	Description
Enable C-Bus Clock	Sets the status of the C-Bus clock.
Enable Burden	Sets the status of the software selectable network burden (only available if the unit address is 001).
Enable Local Toggle	Determines whether the local toggle buttons on the front of the relay can be used to control the channel outputs.
Enable C-Bus Priority	Determines whether new C-Bus commands will override states set via the local toggle buttons.
Allow Current Application Learn	Determines whether learn mode can be used to group channels with other units of the same application address.
Allow Any Application Learn	Determines whether learn mode can be used to group channels with other units of any application address.

Unit Has Learned	Indicates that the unit has been involved in a learn mode operation.

Table C 3 - Global tab parameters

Status Tab

The Status tab shows the current state of the C-Bus relay. It can only be viewed if you are connected to the C-Bus network.

The Status tab is able to display:

- the C-Bus voltage measured at that unit.
- if line/mains power is present.
- if the unit is in Learn Mode.
- if the C-Bus clock is actively being generated by this unit.
- if the network burden is being provided by this unit.
- if the Remote ON or OFF override is active
- if the unit is in local toggle mode.

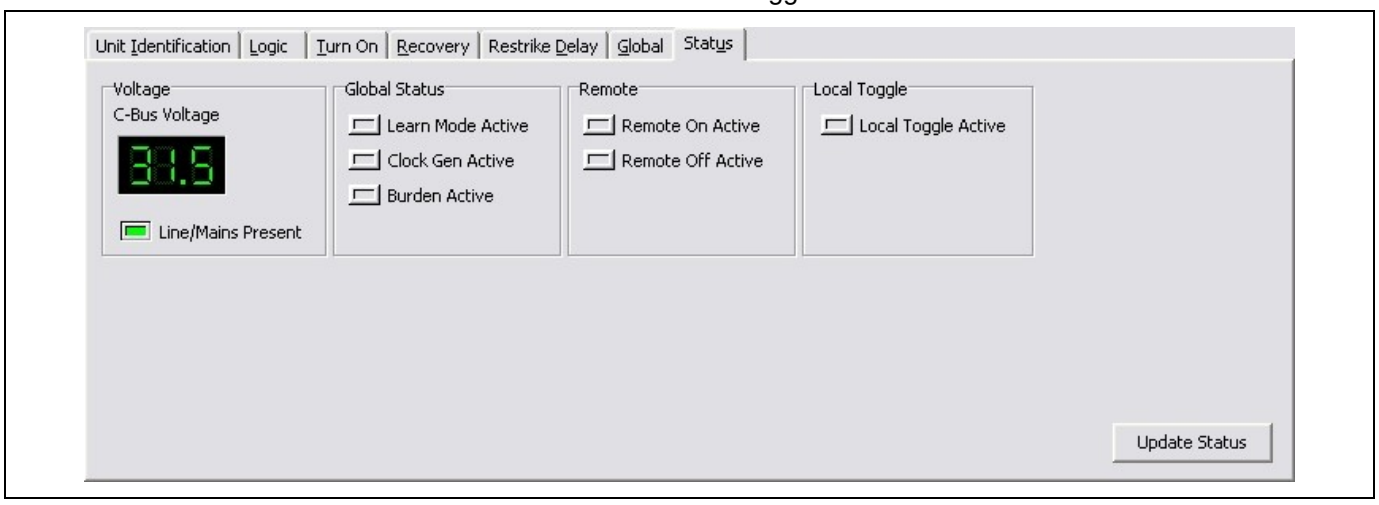


Figure 82 - The Status tab of a relay

DIN Rail Dimmers

To begin programming a DIN rail dimmer, double click on the DIN Rail Dimmer in the Database or Network section of the Programming window. This will open the GUI of the DIN rail dimmer.

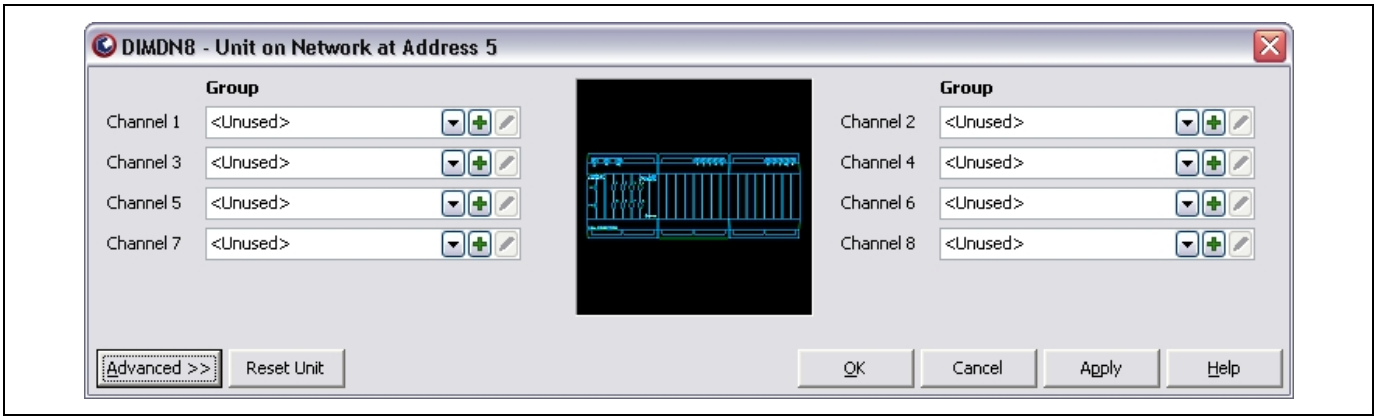


Figure 83 - DIN rail dimmer GUI

To assign a group address to a channel of the dimmer, navigate to the desired channel, and:

- select a group address from the drop down box, or
- create a new group address.

Repeat this for all required channels. If you wish to program or edit any advanced parameters click on the Advanced button. Once all programming has been completed, press the OK or Apply button.

Unit Identification Tab

The Unit Identification tab will display additional programming information inside of the dimmer's GUI as shown below.

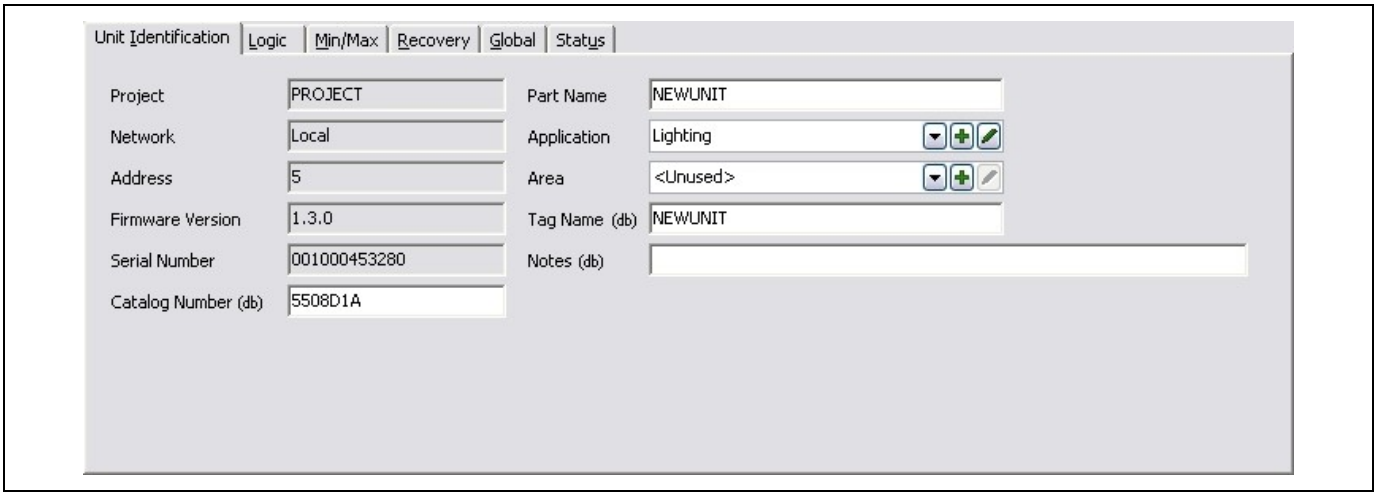


Figure 84 – The Unit Identification tab of a DIN rail dimmer

The Unit Identification tab will display the:

- name of the Toolkit project
- C-Bus network that the unit is on
- unit address of the C-Bus device
- firmware version of the C-Bus device
- serial number of the unit
- catalogue number of the unit.

The table below highlights the more important parameters in the Unit Identification tab.

Parameter	Description
Part Name	Assigns a name to the C-Bus unit, to help identify its physical location. This is an 8 character name which is physically stored in the dimmer.
Application	Selects the application address that the dimmer will operate on.
Area	Specifies an area address for all dimmer channels to respond to.
Tag Name	Assigns a more meaningful name to the C-Bus dimmer. This is only stored in the C-Bus database.
Notes	Documents any nonstandard information about the programming, installation or application the C-Bus dimmer. This is only stored in the C-Bus database.

Table 32 - Important parameters on the Unit Identification tab

NOTE: The Unit Identification tab is common and identical for almost all C-Bus units.

Logic Tab

The Logic tab is separated into two parts:

- logic assignments
- logic recovery

The Logic Assignments allows you to configure 4 low level MIN / MAX operations on the dimmer. This means that the control of the selected channels will be dependant on the Level (0% to 100%) of the associated logic group.

The Logic Recovery will determine the behaviour of the logic group. Logic Recovery will affect the level (0% to 100%) that the logic group will return to after power up, allowing the selection of:

- N/C (no change, which restores to its previous level)
- OFF
- a level (1% to 99% which is technically ON when using a relay)
- ON

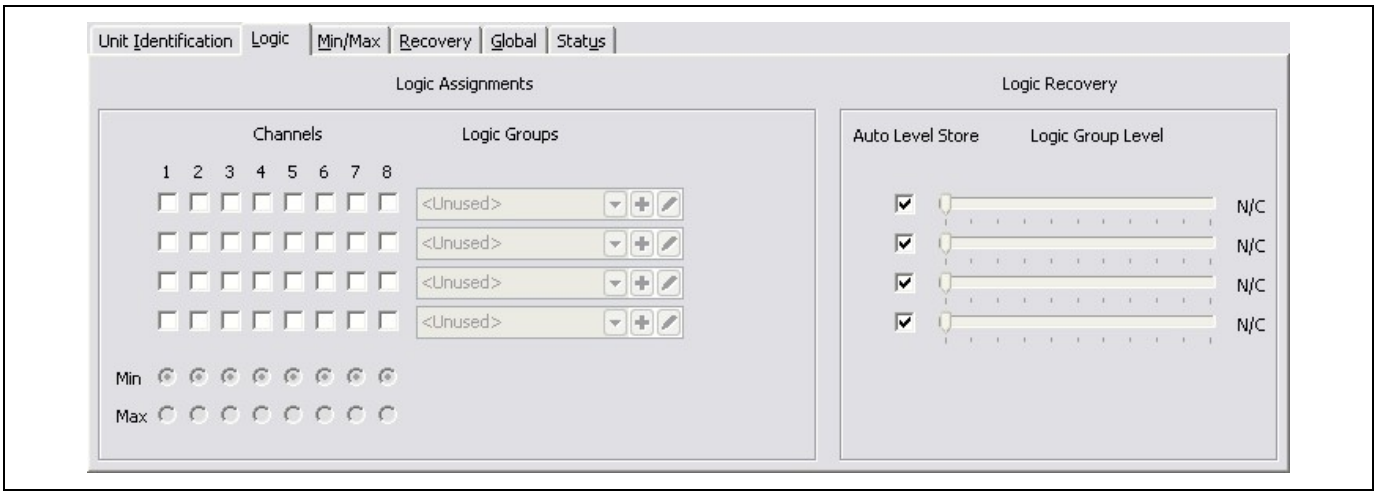


Figure 85 - The logic tab of a dimmer

Below is an example of a simple MIN Logic Condition. You will see that there are 3 parts to programming the logic condition:

- selecting the dimmer channels that you want to operate with logic.
- selecting a logic group from the drop down box.
- selecting the logic operator (MIN logic) to link the selected dimmer channel's group address and the logic group.

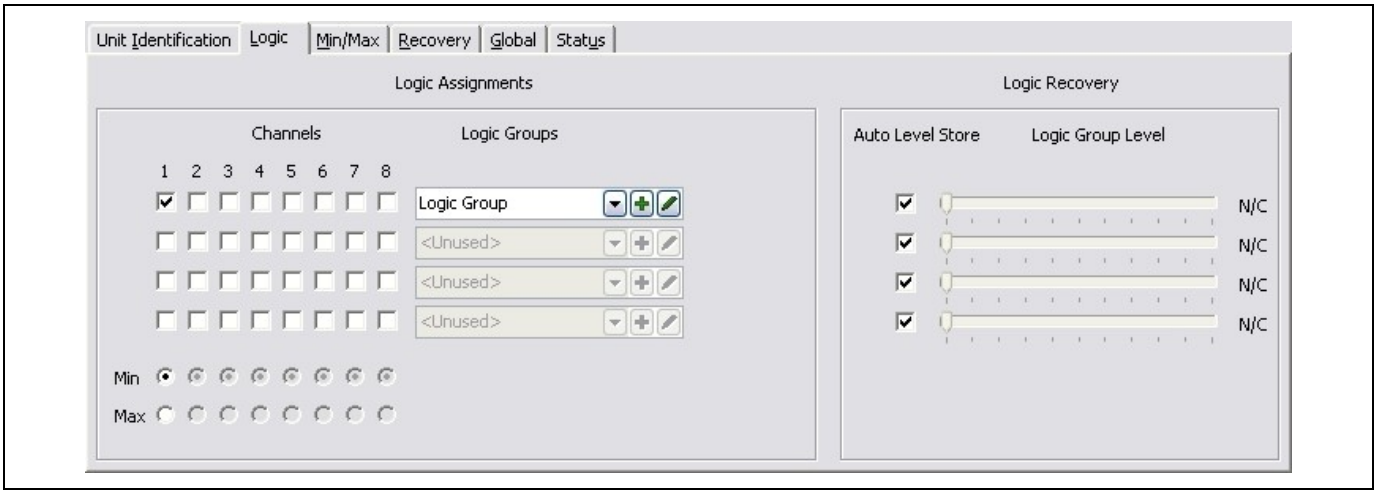


Figure 86 - Dimmer using MIN logic

When using minimum logic on a dimmer, the output of the selected channels are capped at the level of the logic group address. The load output will always reflect the minimum level between the group address and logic group address levels.

The images below show the relationships between the level of the:

- group address
- logic group
- load on the dimmer channel.

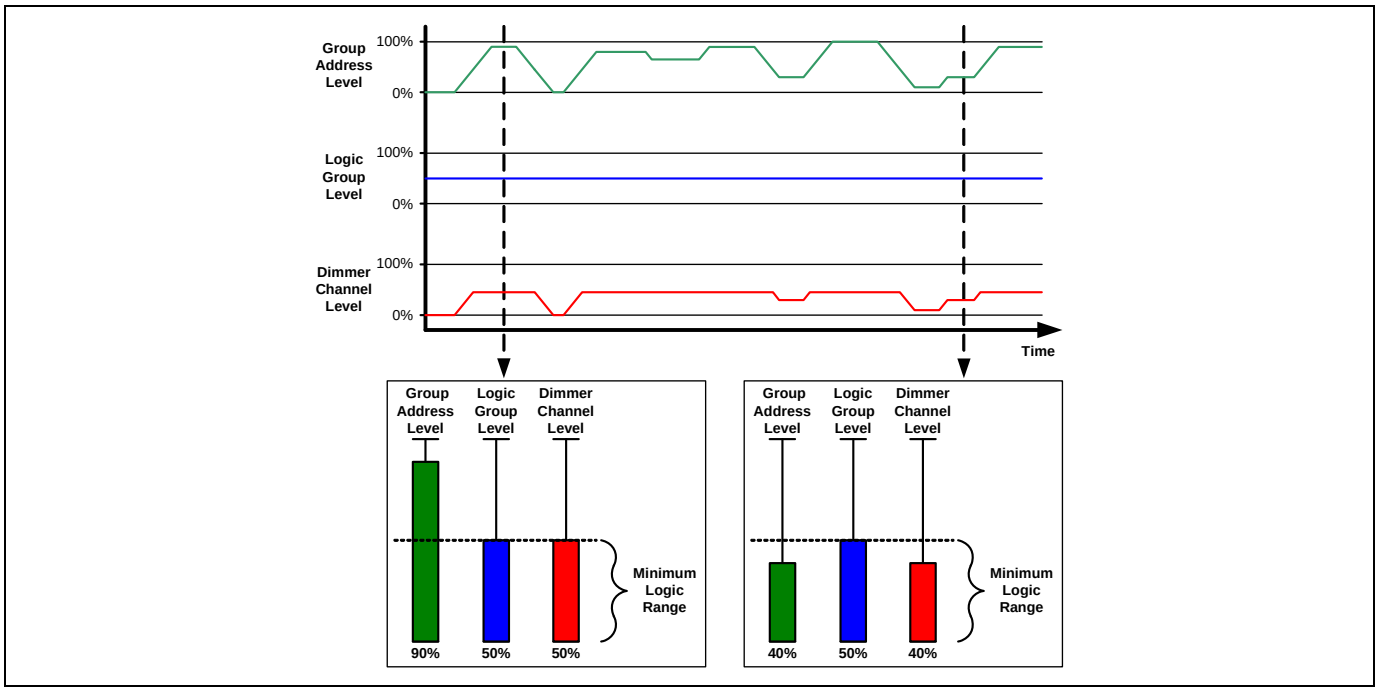


Figure 87 - How minimum logic works on a dimmer

Below is an example of a simple MAX logic condition. You will see that there are 3 parts to programming the logic condition:

- selecting the dimmer channels that you want to operate with logic.
- selecting a logic group from the drop down box.
- selecting the logic operator (MAX logic) to link the selected dimmer channel's group address and the logic group.

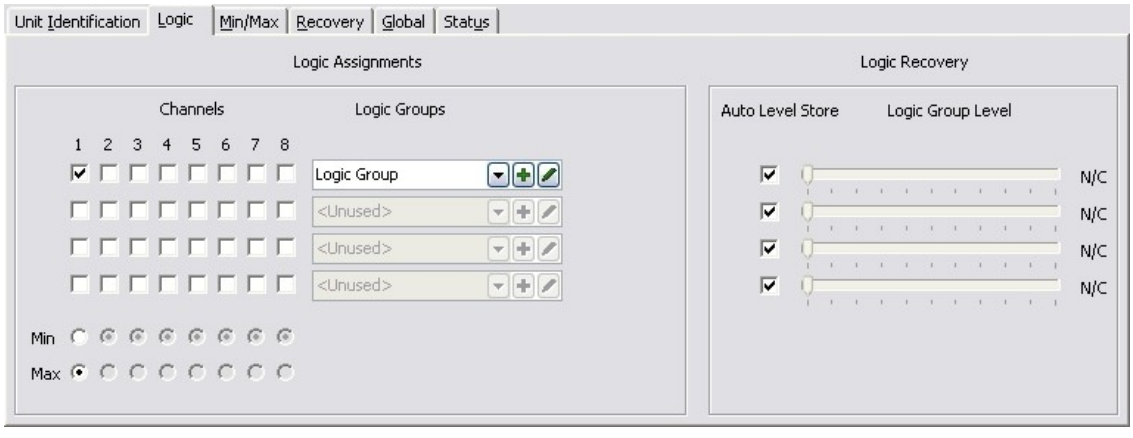


Figure 88 - Dimmer using MAX logic

When using Maximum Logic on a dimmer, the output will always reflect the maximum level between the group address and Logic group address levels.

The images below show the relationships between the level of the:

- group address
- logic group
- load on the dimmer channel.

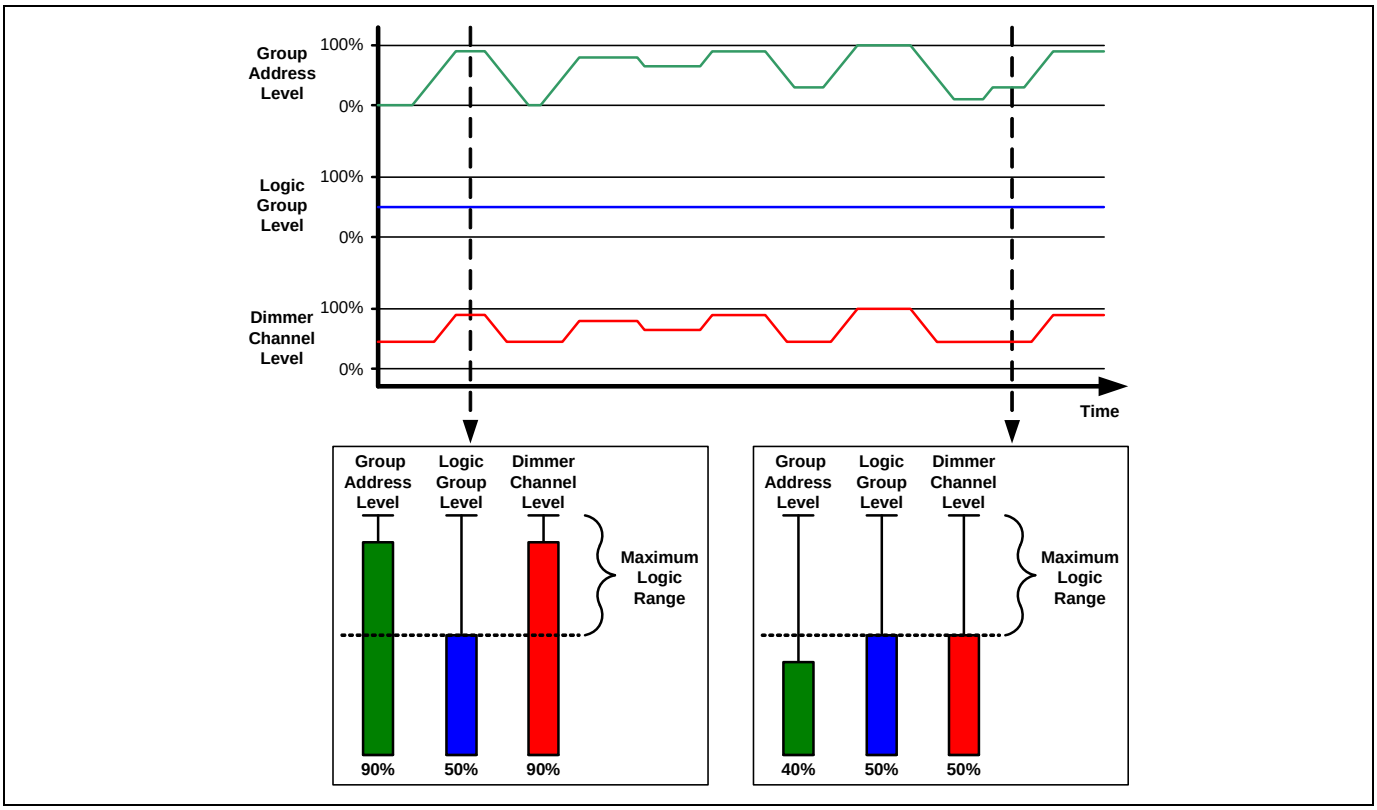


Figure 89 - How maximum logic works on a dimmer

Min/Max Tab

The Min/Max tab allows you to fix a minimum and maximum limits for the dimming channel to operate in. Adjusting the relevant sliders will set the minimum and maximum limits for each individual dimming channel.

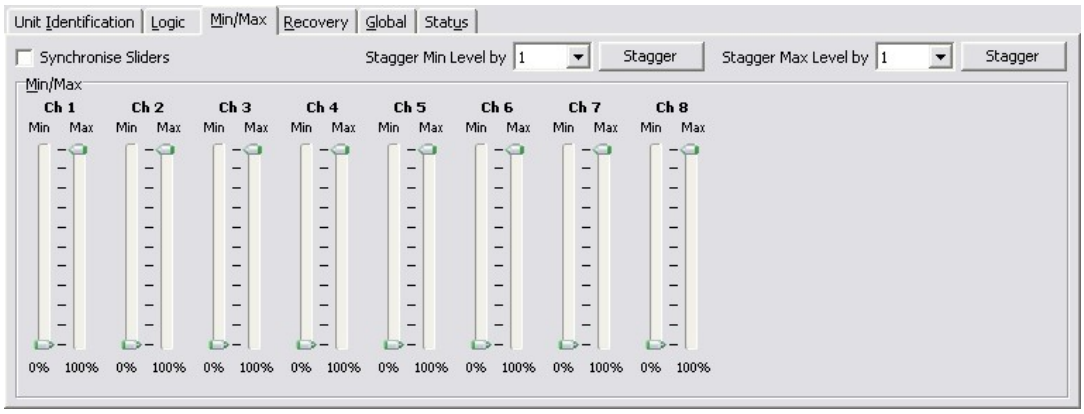


Figure 90 - The Min/Max tab of a dimmer

The image below shows the behaviour of a dimming channel with Min = 30% and Max = 70%.

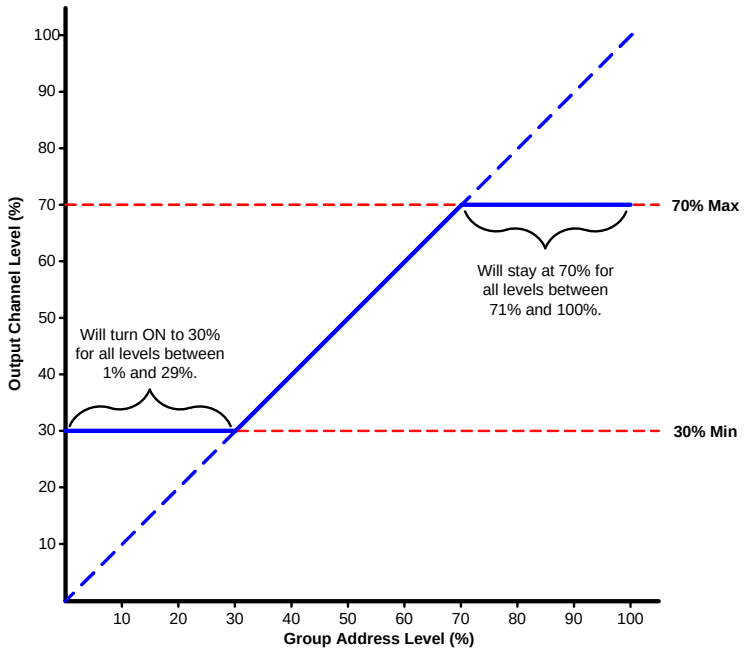


Figure 91 - Behaviour of a dimmer channel with min and max levels

By reducing the maximum limit from 100% to 90% on each dimming channel, you will be able to:

- increase the life of the load
- reduce the amount of energy used by lights.

Recovery Tab

The Recovery tab affects the behaviour of each dimmer channel on power up.

If the C-Bus dimmer loses it mains power, the unit will shut down. When mains power is restored to the C-Bus dimmer, the channels will (by default) restore to the previously known levels after the specified delay period (default 5 seconds).

By removing the tick from a relay channel's check box, the following behaviours may be programmed into each individual channel, after mains power is restored:

- turn ON (100%)
- turn OFF (0%)
- set level using the slider (1% to 99%).

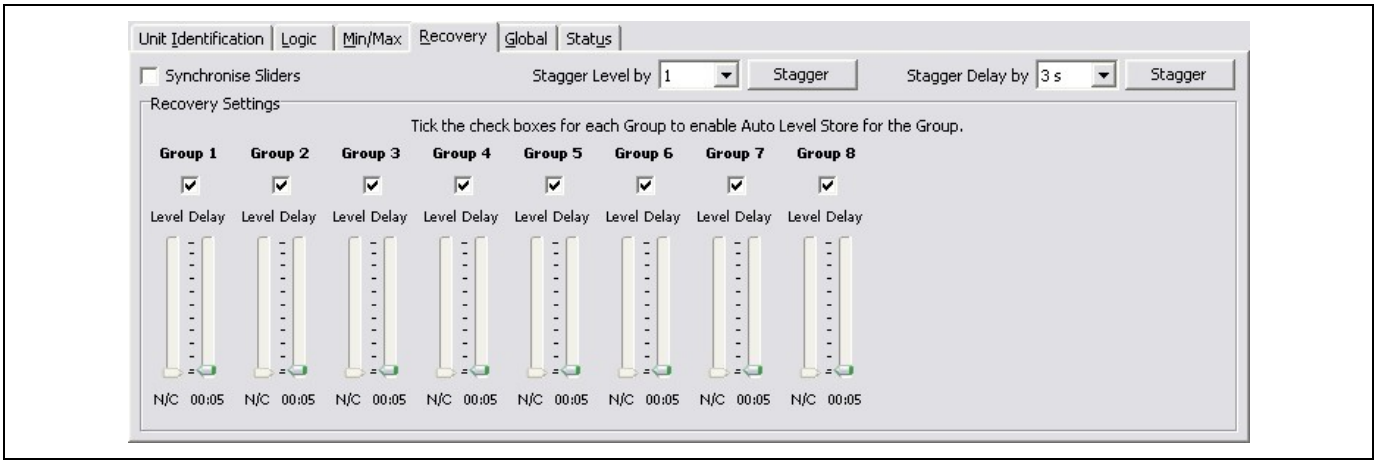


Figure 92 - The Recovery tab of a dimmer

Global Tab

The Global tab allows various parameters to be configured for the entire relay unit.

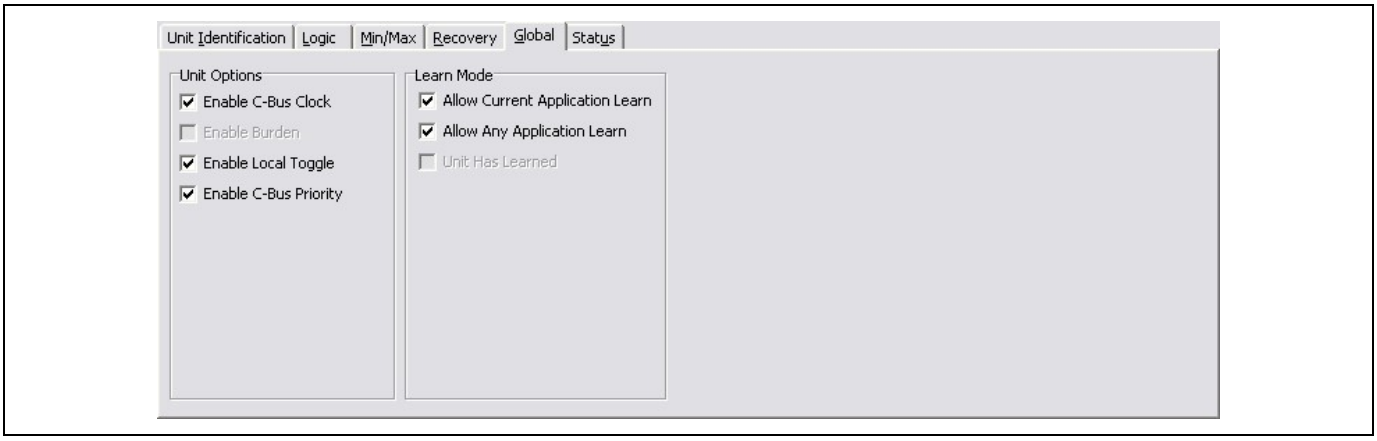


Figure 93 - The Global tab of a dimmer

The table below identifies the parameters on the Global tab, and their function.

Parameter	Description
Enable C-Bus Clock	Sets the status of the C-Bus clock.
Enable Burden	Sets the status of the software selectable network burden (only available if the unit address is 001).
Enable Local Toggle	Determines whether the local toggle buttons on the front of the dimmer can be used to control the channel outputs.
Enable C-Bus Priority	Determines whether new C-Bus commands will override states set via the local toggle buttons.
Allow Current Application Learn	Determines whether learn mode can be used to group channels with other units of the same application address.
Allow Any Application Learn	Determines whether learn mode can be used to group channels with other units of any application address.
Unit Has Learned	Indicates that the unit has been involved in a learn mode operation.

Table 33 - Global tab parameters

Status Tab

The Status tab shows the current state of the C-Bus dimmer. It can only be viewed if you are connected to the C-Bus network.

The Status tab is able to display:

- the C-Bus voltage measured at that unit.
- if line/mains power is present.
- if the unit is in Learn Mode.
- if the C-Bus clock is actively being generated by this unit.
- if the network burden is being provided by this unit.
- if the Remote ON or OFF override is Active
- if the unit is in local toggle mode.

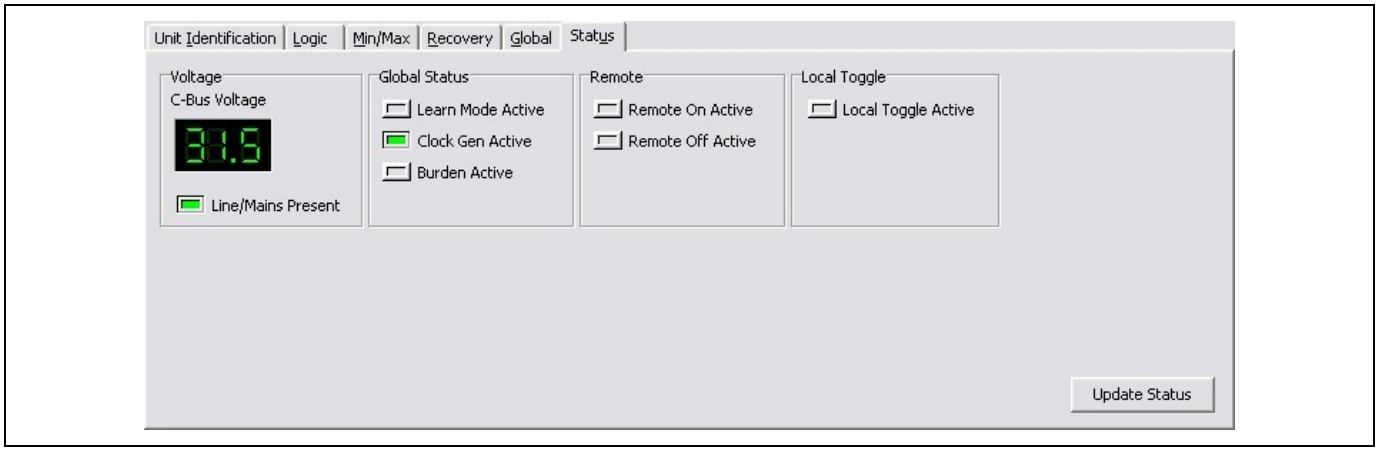


Figure 94 - The Status tab of a dimmer

Basic Wall Switch Programming

There are various types of C-Bus wall switches, which all have slightly different features and programming options. While all C-Bus wall switches are slightly different, basic programming is common across the range.

To begin programming a C-Bus wall switch, double click on the unit in the Database or Network section of the Programming window. This will open the GUI of the wall switch.

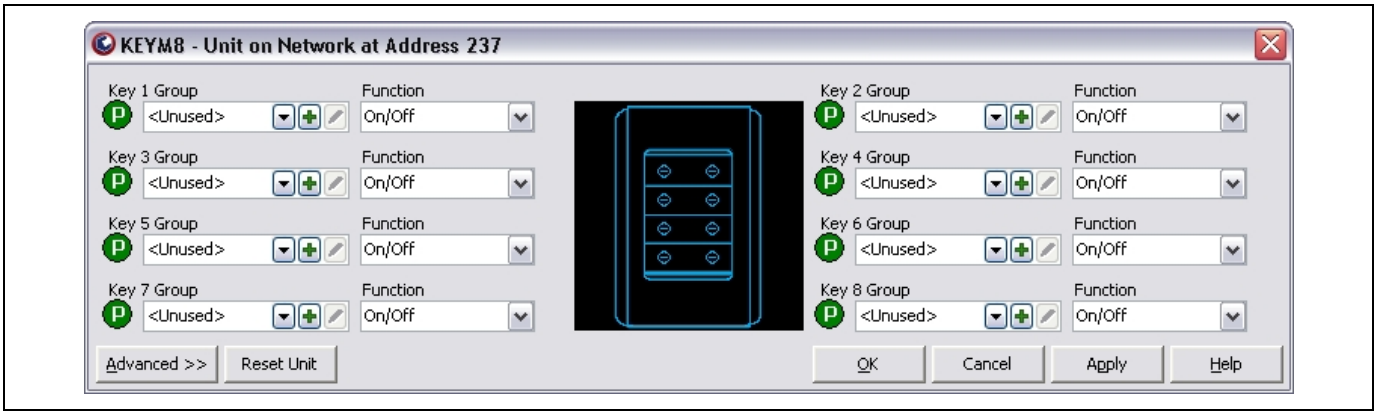


Figure 95 - 8 Button C-Bus Neo Wall Switch GUI

There are 5 key elements to programming a C-Bus wall switch that are outlined in the table below.

Parameter	Description
Application icon	If the C-Bus wall switch is able to communicate to 2 application addresses, you may select which application the wall switch button is on. This is done by clicking on the Primary Application icon (P) or the Secondary Application icon (S). If the C-Bus wall switch only communicates on a single application address, these icons will not appear.
Group address	Each button for the C-Bus wall switch is assigned a group address. This is achieved by using the appropriate buttons, such as the: • Drop down box to select an existing group address (▼). • Create a New Group Address (+) button. • Edit an Existing Group Address (✎) button.
Function	The Function is a drop down box that allows you to select the behaviour of the wall switch button. Some of the more commonly used functions include On/Off, Dimmer, Timer, Presets etc.
Function details	Function Details may be accessed by clicking on the Function Details Button (☰), which is found directly to the right of the Function drop down box. This will edit the behaviour of the selected function, allowing the editing of details such as the duration of timers, the level of a preset etc. If the Function Details button does not appear, then there are no details to edit for the selected function.

Table 34 - Basic elements to programming a C-Bus wall switch

The table below lists the more commonly used functions that are assigned to the buttons of a C-Bus wall switch.

Function	Description
Unused	This function will have no affect on the wall switch button.
ON	Turns the group address ON (100%).
OFF	Turns the group address OFF (0%).
ON / OFF	Toggles the group address ON and OFF from the same button, each time it is pressed.
Dimmer	Toggles the group address ON and OFF from the same button, each time it is pressed. If the button is held down, the group address will ramp up or down until the button is released.
On Up	Toggles the group address between OFF (0%) and the previous ON level. If the button is held down, the group address ramps up until the button is released.
Off Down	Toggles the group address between OFF (0%) and the previous ON level. If the button is held down, the group address ramps down until the button is released.
Timer	Turns ON the group address and start a timer. Once the timer reaches a specified limit, it will execute the action in the expiry function (usually turn the group address OFF).
Bell Press	Turns the group address to ON while the button is held down. It will then turn the group address OFF once the button is released.
Dimmer Up	Turns the group address ON (100%). If the button is held down, the group address will only ramp up until the button is released.
Dimmer Down	Turns the group address OFF (0%). If the button is held down, the group address will only ramp down until the button is released.
Soft Up	Turns the group address ON (100%). If the button is held down, the group address will only ramp up until the button is released.
Soft Down	Ramps the group address to Off. If the button is held down, the group address will only ramp down until the button is released.
Preset 1 & 2	Sets the group address to the specified level. If the button is held down, the group address will ramp off.

Table 25 – Commonly used functions on a C-Bus wall switch

Many of these functions have an associated function so they can operate with 2 button control. The complementary functions are:

- ON and OFF
- ON Up and OFF Down
- Dimmer Up and Dimmer Down
- Soft Up and Soft Down.

There are some additional functions that relate directly to using the C-Bus Shutter Relay. These key functions are listed in the table below.

NOTE: These Functions work in association with the C-Bus Shutter Relay. While the function may control part of the operation, the C-Bus Shutter Relay will take control of other parts to the function.

Function	Description
Shutter Toggle	This function causes the C-Bus Shutter Relay to: • Open the shutter • Stop from opening • Close the shutter • Stop from closing
Shutter Open Toggle	Causes the C-Bus Shutter Relay to Open and Stop
Shutter Close Toggle	Causes the C-Bus Shutter Relay to Close and Stop
Shutter Open	Causes the C-Bus Shutter Relay to Open
Shutter Close	Causes the C-Bus Shutter Relay to Close
Shutter Stop	Causes the C-Bus Shutter Relay to Stop in its current position

Table 36 - Key functions used specifically with the C-Bus Shutter Relay

The C-Bus Shutter Relay functions are designed to operate with 1, 2 or 3 button control. If you wish to use:

- 1 button control, use the Shutter Toggle function.
- 2 button control, use the Shutter Open Toggle and Shutter Close Toggle functions.
- 3 button control, use the Shutter Open, Shutter Close and Shutter Stop functions.

Advanced Wall Switch Programming

There are many different parameters in different C-Bus wall switches. The following section of advanced wall switch programming, highlights the more commonly used configuration parameters.

NOTE: The following programming options are taken from an 8 Button C-Bus Neo Wall Switch. Some parameters may not be applicable or may be programmed slightly differently to other C-Bus wall switches, e.g. 2000 Series, Reflection, Saturn and DLT ranges.

Dual Applications

To use dual applications on a C-Bus wall switch, open the GUI for the wall switch and navigate to the Unit Identification tab, by viewing the Advanced settings as shown below. You will see that the primary application address defaults to Lighting, and the secondary application address defaults to <Unused>.

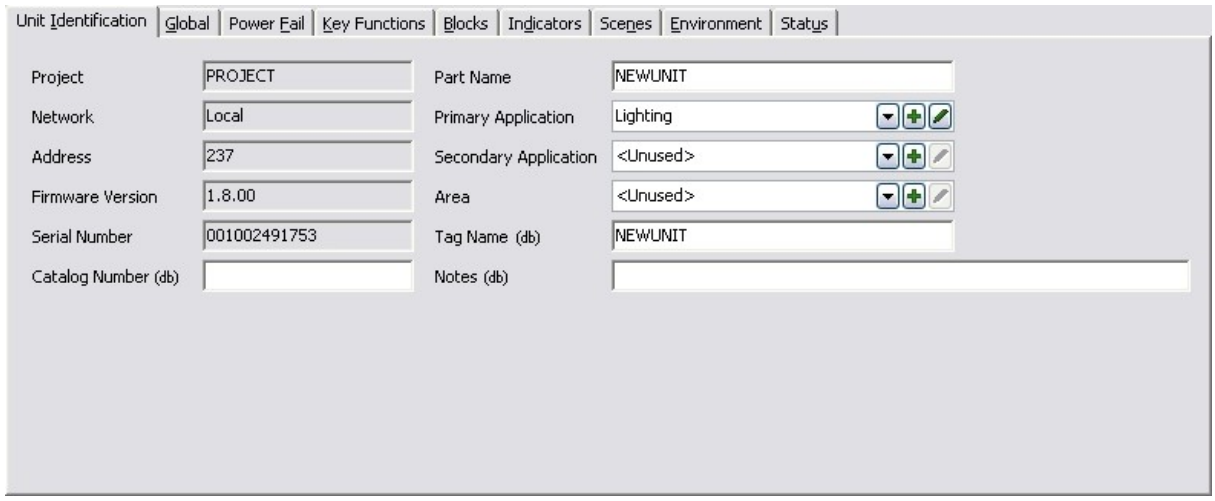


Figure 96 -The Unit Identification tab of a C-Bus wall switch

Once you select a secondary application address from the drop down box, you will be able to toggle the application address that is assigned to a specific button. This is done by clicking on the P or S icons as shown below.

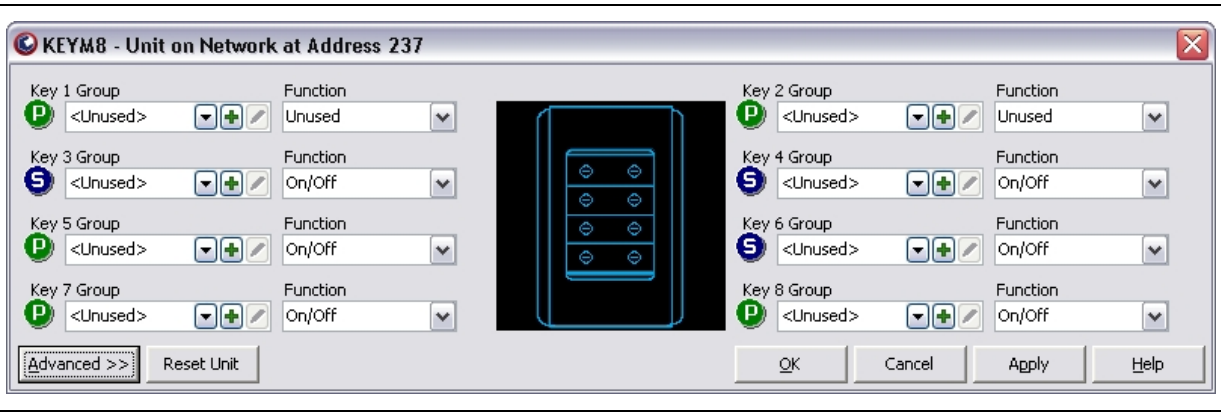


Figure 97 - An 8 Button C-Bus Neo Wall Switch using two application addresses

Indicators

To configure the behaviour of the indicators on a C-Bus wall switch, navigate to the Indicators tab, and you will find that there is usually 4 different behaviours which can be configured:

- Indicator Brightness
- Key Press Activity
- Indicator Options
- Indicator Assignments.

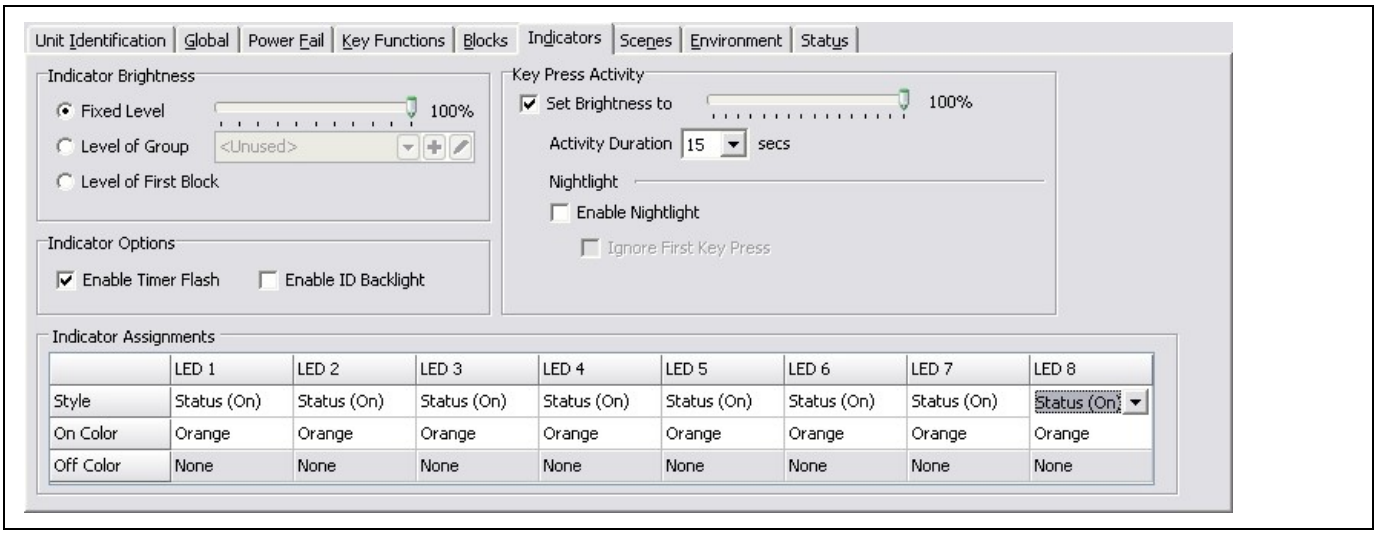


Figure 98 - The indicator tab of an 8 Button C-Bus Neo Wall Switch

Each C-Bus button on a wall switch has an indicator. The brightness of this indicator may be adjusted using the parameters in the Indicator Brightness section of the Indicators tab. These Indicator Brightness parameters are actually fallback levels. This means if the buttons on the wall switch have not been pressed for a period of time, they will go to the specified brightness.

Parameter	Description
Fixed Level	This will set the brightness of all indicators on the wall switch to a fixed brightness between 0% and 100%.
Level of Group	This will set the brightness of all indicators on the wall switch to follow the Level (0% to 100%) of a specified group address.
Level of First Block	This will set the brightness of all indicators on the wall switch to follow the Level (0% to 100%) of the group address stored in Block 1 of the Blocks tab.

Table 37 - Indicator Brightness parameters

Each time a button is pressed on a wall switch the indicators will behave according to the 'Key Press Activity' parameters on the Indicator tab.

Parameter	Description
Set Brightness To	This will set the brightness of all indicators on the wall switch to a fixed level when the button is pressed.
Activity Duration	This will set the time that the indicator will stay at the specified brightness, before falling back to the level of the 'Indicator Brightness' parameters.
Enable Nightlight	This parameter will enable dimly lit indicators to help find the wall switch in the dark.
Ignore First Key Press	When enabled, this parameter will not send a C-Bus message to the network when any button on the wall switch is pressed for the first time.

Table 38 - Key press activity parameters

There are two general parameters that affect the indicators on a C-Bus wall switch. These parameters fall under the Indicator Options parameters on the Indicator Tab.

Parameter	Description
Enable Timer Flash	This will flash the indicator to show that a timer is running.
Enable ID Backlight	This will turn on some indicators behind the buttons on the wall switch. This will emit a soft glow behind the buttons to help identify the wall switch in the dark.

Table 39 - Indicator Options parameters

The Indicator Assignments parameters allow you to specify the operation and colour of each button on the C-Bus wall switch.

Parameter	Description
Style	This will allow the selection of one of 4 styles of indicator behaviour for each button. • Always ON, which will always be lit up. • Always OFF, which will never be lit up. • Status (ON), will turn a single colour indicator ON and OFF. • Status (Dual), will toggle the indicators between the 2 colours.
On Colour	This will allows you to select an orange or blue colour for when the button is ON.
Off Colour	If the style of the button indicator is set to Status (Dual), then Toolkit will automatically select the remaining colour for when the button is OFF. E.g. If Orange is selected for the ON Colour, Blue will automatically be selected for the OFF Colour.

Table 40 - Indicator Options parameters

Disable All Keys

The Disable All Keys parameter can be found on the Global tab of the C-Bus wall switch. This parameter will stop the C-Bus wall switch from operating if a specified group address is ON or OFF.

Parameter	Description
Group	This will allow the selection of the group address that will disable the C-Bus wall switch. This group address is on the Enable application.
Disables When	This will allow you to select in which state (ON or OFF) the selected group address must be in, for the wall switch to be disabled.

Table 41 - Disable All Keys parameter

The figure below shows the parameters used to disable the buttons of the C-Bus wall switch.

Figure 99 - The Disable All Keys parameter

Blocks

When you select a group address, assign a function to the key/button, and then select the Function Details button, all of that programming information is viewed on the Blocks tab. The Blocks tab of a C-Bus wall switch allows you to program some of the more advanced settings on the unit.

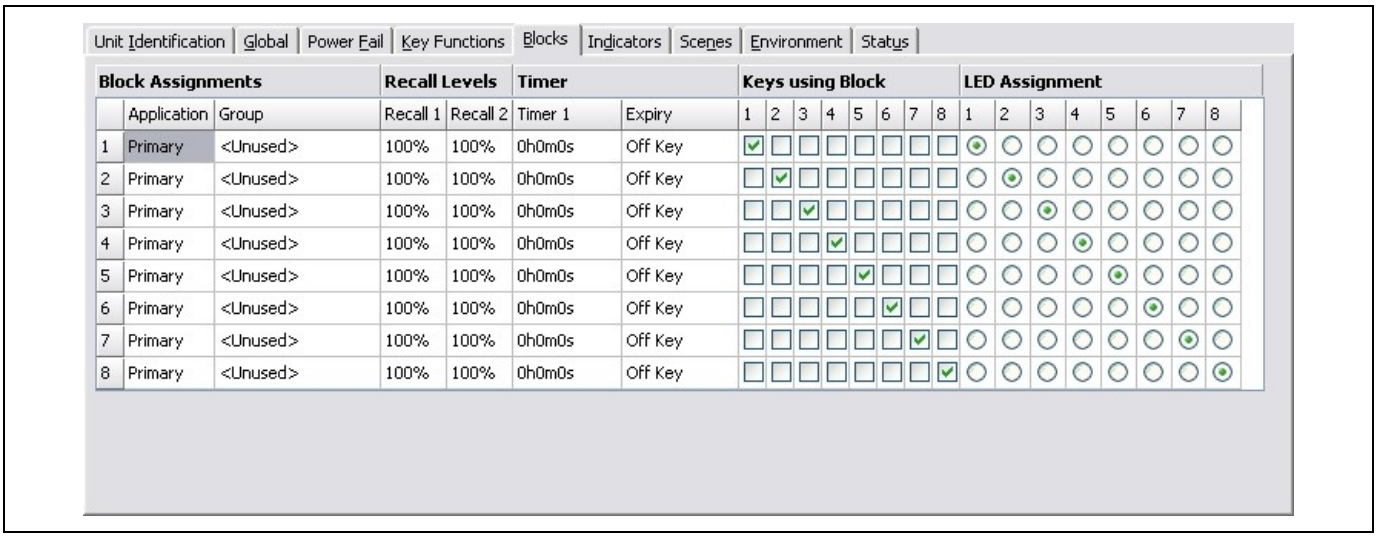


Figure 100 - The Blocks tab of a wall switch

The Block tab is categorised into 5 different areas:

- Block Assignments
- Recall Levels
- Timer
- Keys Using Block
- LED Assignments.

The Block Assignments section allows you to select the Primary or Secondary application. Depending on which application address is selected, the appropriate group addresses will be selectable from the Group drop down box.

Each group address that we program into a C-Bus wall switch, is stored into a memory location which is known as a block.

The Recall Levels section of the Blocks tab will allow you to store 2 fixed percentage levels into a Block. These Recall levels is where the level of a Preset key function will be stored.

The Timer section of the Blocks tab will allow you to specify the duration of a timer and its Expiry function into a block.

The Keys Using Block section of the Blocks tab will allow you to specify which button of the C-Bus wall switch will control the group address inside of the block. By using a matrix of check boxes you may select:

- a single key/button to control a single block
- a single key/button to control multiple blocks
- multiple keys/buttons to control a single block
- multiple keys/buttons to control a multiple blocks.

NOTE: Care must be taken when controlling multiple blocks, as the group addresses may easily get out of sync, depending on the programming of other C-Bus input units.

The LED Assignment section of the Blocks tab will allow you to specify which LED indicator will link to a block.

Corridor Linking

Corridor linking is the process of ensuring that the corridor lights are always on, while any of the rooms/offices that use the corridor are occupied. Corridor linking may be configured by programming the parameters on the Environment tab of a C-Bus wall switch.

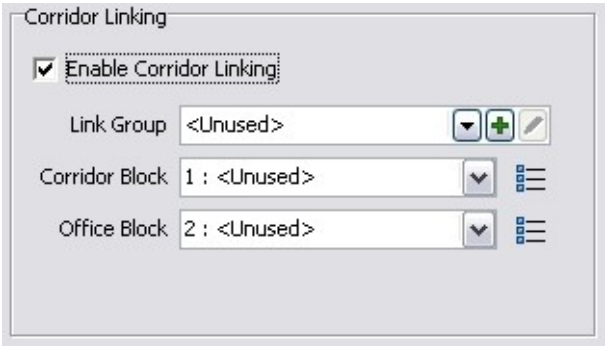


Figure 101 - Corridor linking parameters on the Environment tab

There are 4 parameters that are used to setup corridor linking.

Parameter	Description
Enable Corridor Linking	This check box will enable the Corridor Linking functionality in the C-Bus wall switch.
Link Group	The Link Group is a group address that is common to all C-Bus wall switches that control the Corridor Light.
Corridor Block	The Corridor Block allows you to select the group address of the Corridor Light.
Office Block	The Office Block allows you to select the group address of the Office.

Table 42 - Corridor Linking parameters

Timing Parameters

Timing parameters play a large part in the operation of C-Bus input units. They allow the configuration of:

- Debounce
- Long Press
- Ramp 1
- Ramp 2
- Status Report.

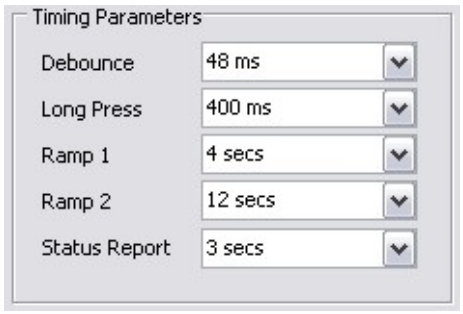


Figure 102 - The Timing parameters on the Global tab

All mechanical switches bounce, when they close. The Debounce parameter specifies a time period (48 ms by default) where all of the mechanical bounce is ignored unit there is stable contact.

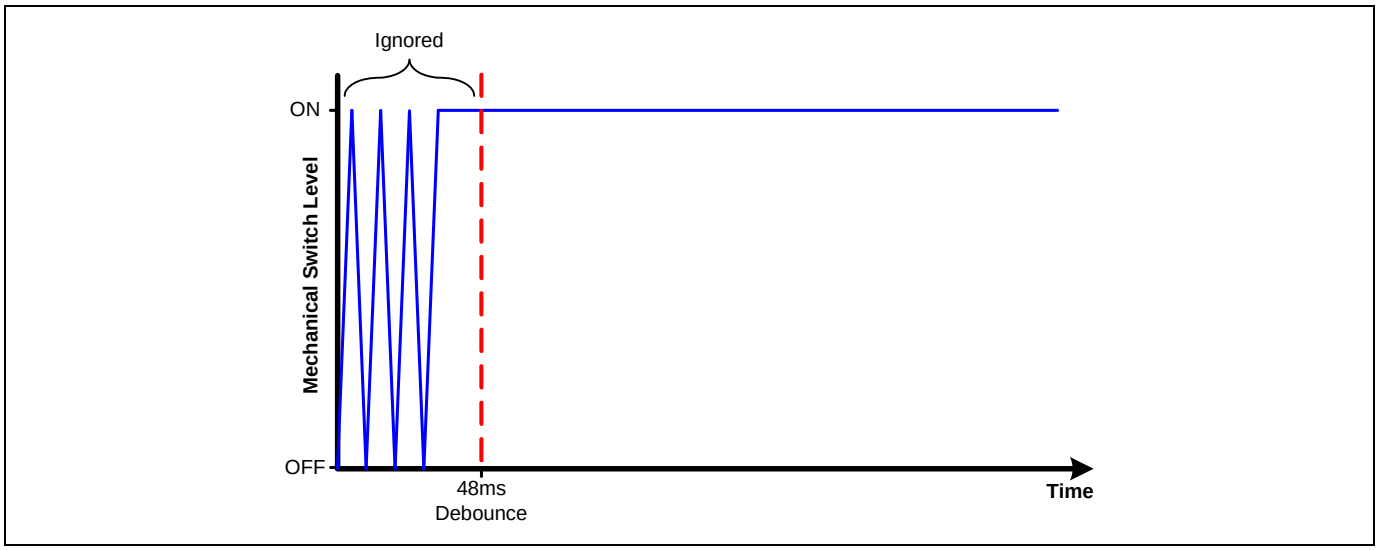


Figure 103 - Debounce ignoring the mechanical bounce of a switch

All C-Bus input units respond differently depending on how the user interacts with it. One of these interactions is how long the button of a C-Bus wall switch is pressed. If a button has a dimmer function:

- a quick press of the button will toggle the group address ON and OFF
- a longer press (by holding down the button) will ramp the group address Up and Down.

The Long Press parameter allows us to specify the difference between short press of the button, and a long press of the button (giving different functionality).

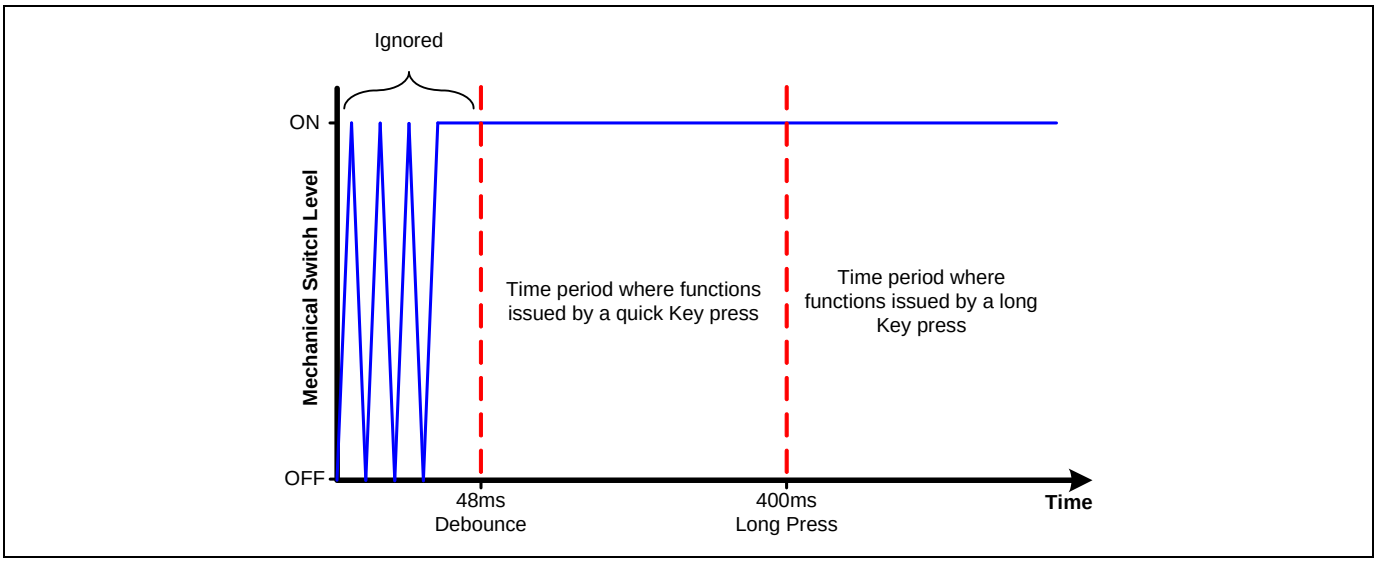


Figure 104 - Long press limit that allows additional functions

The Ramp 1 parameter specifies the time taken to ramp a light from minimum to maximum brightness (or vice versa), using the Up Key, Down Key or Down Cycle Key micro functions. The default value is 4 seconds.

The Ramp 2 parameter specifies the time taken to ramp a light from minimum to maximum brightness (or vice versa), using the Ramp Off or Ramp Recall micro functions. The default value is 12 seconds.

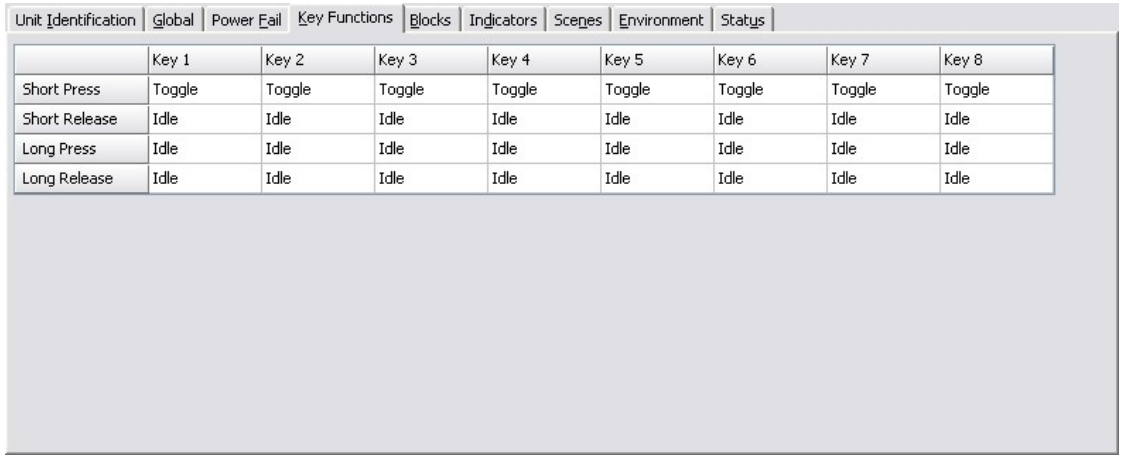
The Status Report parameter allows you to specify how often the multipoint to multipoint interrogation (MMI) error checking process is carried out (3 seconds by default). This will provide an automatic detection and correction of discrepancies between the states of C-Bus input and outputs units.

NOTE: To reduce the frequency of the MMI, the Status Report period must be increased on each C-Bus input unit, on each application address.

Micro Functions

When a button on a C-Bus wall switch is pressed, the behaviour of the selected group address is specified by the key function e.g. ON/OFF, Dimmer, Timer, Bell Press, Preset etc.

Every single key function consists of 4 micro functions, which are strategically selected to achieve the desired outcome. To view the micro functions that make up a key function, navigate to the Key Functions tab of the C-Bus wall switch.



	Key 1	Key 2	Key 3	Key 4	Key 5	Key 6	Key 7	Key 8
Short Press	Toggle	Toggle	Toggle	Toggle	Toggle	Toggle	Toggle	Toggle
Short Release	Idle	Idle	Idle	Idle	Idle	Idle	Idle	Idle
Long Press	Idle	Idle	Idle	Idle	Idle	Idle	Idle	Idle
Long Release	Idle	Idle	Idle	Idle	Idle	Idle	Idle	Idle

Figure 105 - The Key Functions tab

Here you will see that each key/button consists of 4 micro functions, which are programmed into 4 parameters called:

- Short Press
- Short Release
- Long Press
- Long Release.

The figure below helps to explain when the micro functions are issued.

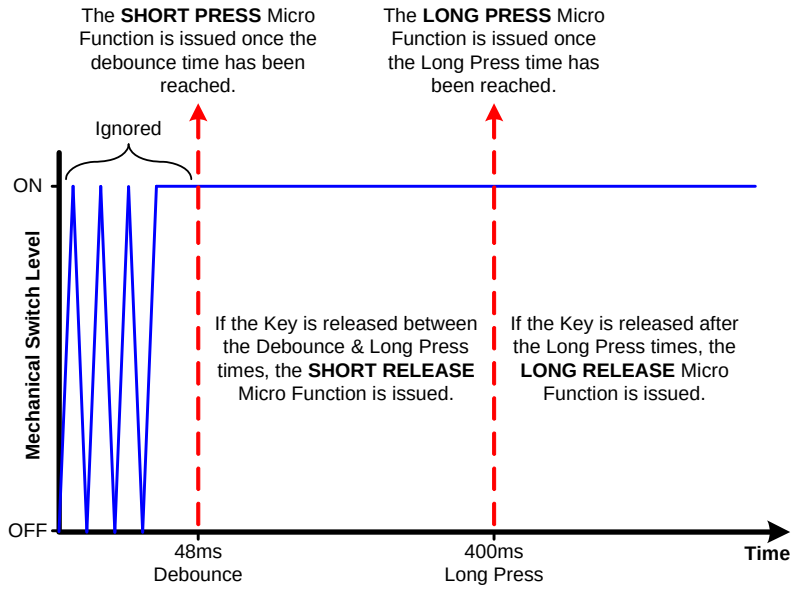


Figure 106 - When the micro functions are sent

Micro Function	Action
Idle	No action
Store 1	This stores the current level in the Recall 1 memory location (Blocks tab). When the Recall 1 function is used, the group address reverts to this level. The level is stored in non-volatile memory. No transmission is made over the C-Bus Network.
Downcycle	The output level is ramped down to minimum. If the output is already at minimum, it ramps up to maximum. The Downcycle function should be used in conjunction with the End Ramp function to ensure that ramping ends at the desired level. The direction of output ramping changes with each successive Downcycle/End Ramp operation. This allows a single button to act as an up / down light dimmer. The Off Key function can be used to terminate ramping if required. A RAMP TO LEVEL message is transmitted over the C-Bus network.
Memory Toggle	If the output is on, the Memory Toggle function stores the current level in the Recall 2 memory location (Blocks tab) and switches the output off. If the output is off, the function sets the output to the last level stored in the Recall 2 memory location (the previous brightness level). An OFF or RAMP TO LEVEL message is transmitted over the C-Bus network.
Down Key	This function is similar to Downcycle except that it can only ramp the output level downwards. The output will be ramped to the minimum level unless either the End Ramp or Off Key function terminates the process early. The ramp rate for the Down Key function is set by the Ramp 1 parameter (Global tab). The Down Key function has no effect if the current output is in the off state. A RAMP TO LEVEL message is transmitted over the C-Bus network.
Up Key	The output level increases to the maximum level, unless either the End Ramp or Off Key function ends the process early. The ramp rate for the Up Key function is set by the Ramp 1 parameter (Global tab). If the current level is already at a maximum, no action will occur. A RAMP TO LEVEL message is transmitted over the C-Bus network.
Recall 1	The output level is set to the level stored in the Recall 1 memory location (Blocks tab). A RAMP TO LEVEL message is transmitted over the C-Bus network.
Recall 2	The output level is set to the level stored in the Recall 2 memory location (Blocks tab). A RAMP TO LEVEL message is transmitted over the C-Bus network.
Retrigger Timer	The retrigger timer command starts the internal timer only if the output is currently on (at any level). If the output is already on, the timer is restarted. A RAMP TO LEVEL message is transmitted over the C-Bus network.
Start	The internal timer is started without affecting the output level (if the timer value is greater than zero). An ON message may be transmitted over the C-Bus network.
Ramp Off	The output level is ramped to the minimum level and then switched off. The ramp rate is set by the Ramp 2 parameter (Global tab). This function cannot be interrupted by the End Ramp function. A RAMP TO LEVEL message is transmitted over the C-Bus network.
Ramp Recall 1	The output level is ramped up or down (depending on the current level), to the level stored in the Recall 1 memory location (Blocks tab). The ramp rate is set by the Ramp 2 parameter (Global tab). This function cannot be interrupted by the End Ramp function. A RAMP TO LEVEL message is transmitted over the C-Bus network.

Toggle	If the output is currently off, it is set to the maximum level. Otherwise it is switched off. An ON or OFF message is transmitted over the C-Bus network.
On Key	If the output is off, it is set to the maximum level. Otherwise no action is taken. An ON message may be transmitted over the C-Bus network.
Off Key	If the output is not off, it is switched off. Otherwise no action is taken. An OFF message may be transmitted over the C-Bus network.
End Ramp	The ramping action initiated by a Downcycle, Down Key or Up Key function is terminated. This allows an output to be set at an intermediate level. A RAMP TO LEVEL message is transmitted over the C-Bus network.

Table 43 - The different type of micro functions

Passive Infrared Sensors

Before programming a PIR, it is important to adjust the Light Level Trimpot for the appropriate light level which it is to operate in. When the Light Level Trimpot (which is physically located on the PIR) is adjusted:

- Fully clockwise, the PIR will only detect in darkness.
- Fully anticlockwise, the PIR will detect when natural light is present.
- To a midpoint to achieve a finer and more specific light level threshold.

PIR Programming

To begin programming a passive infrared (PIR) sensor, double click on the PIR in the Database or Network section of the Programming window. This will open the GUI of the PIR sensor.

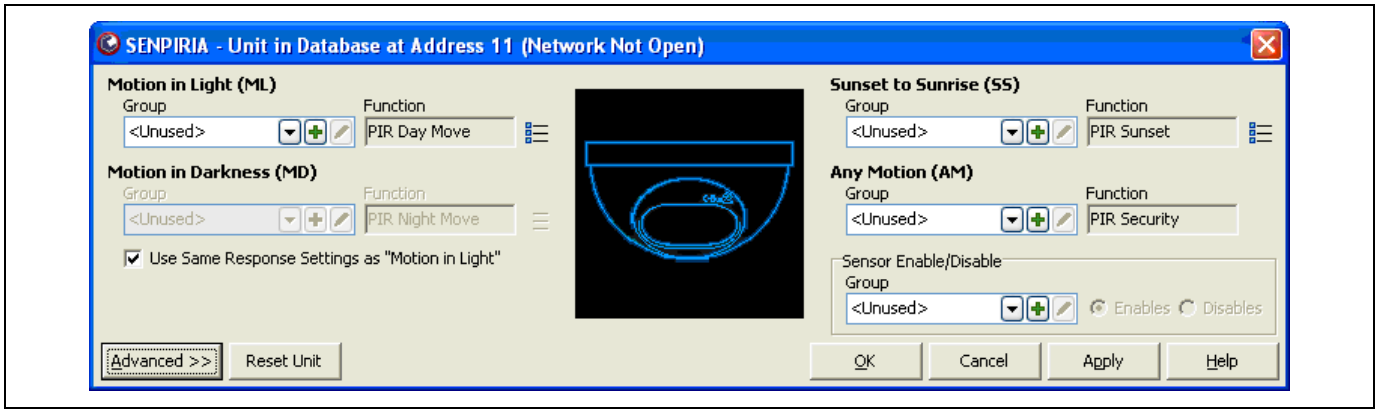


Figure 107 - The Passive Infrared (PIR) Sensor GUI

Since a PIR sensor does not have buttons, specific functions are pre-programmed to control group addresses. These function are highlighted in the table below.

Parameter	Description
Motion in Light (ML)	When movement is detected, this parameter will continually retrigger a running timer, when the ambient light in the room is above the threshold set by the light level trimpot.
Motion in Dark (MD)	When movement is detected, this parameter will turn on a group address and continually retrigger a running timer, when the ambient light in the room is below the threshold set by the light level trimpot.
Sunrise to Sunset (SS)	This parameter will turn on a group address for a specified period of time, once the light level falls below the threshold set by the light level trimpot.
Any Motion (AM)	This parameter will continually pulse the group address ON and OFF with each time movement is detected.

Table 44 - PIR sensor functions

The Use Same Response Setting as Motion in Light parameter links the Motion In Light and Motion in Dark parameters. These two functions are linked because once motion is detected in the dark, the light will turn on. Once the light is on, the ambient light level at the PIR sensor will no longer be dark, so the sensor will continue to detect motion in light.

PIR Function Details

Once you have assigned a group address to the ‘Motion In Light’ and ‘Motion in Dark’ parameters, click on the appropriate Function Details button to set the behaviour of the PIR’s timer. This will allow you to configure the:

- duration of the timer
- Expiry function.

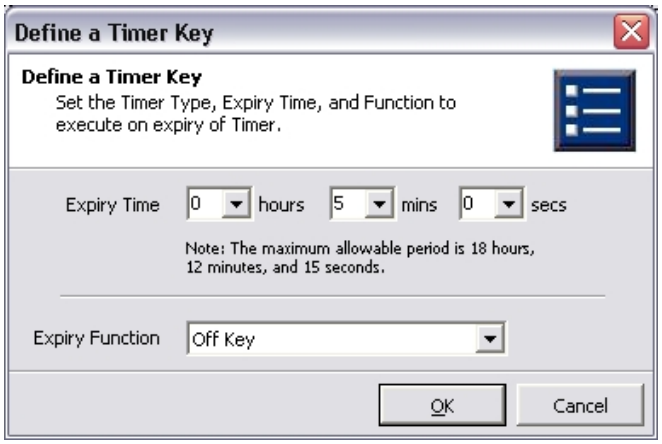


Figure 108 - The function details GUI for a PIR sensor

Sensor Enable/Disable

The Sensor Enable/Disable parameter can be found on the simple programming view of a C-Bus PIR sensor. This parameter will stop the PIR sensor from operating if a specified group address is ON or OFF.

Parameter	Description
Group	This will allow the selection of the group address that will enable or disable the C-Bus PIR. This group address is on the Lighting Application.
Enable / Disable	This will allow you to select in which state (ON or OFF) the selected group address must be in, for the PIR to be enabled or disabled.

Table 45 - Sensor Enable/Disable parameters

False Triggering Sensors

If a PIR sensor is triggering when there is no human movement, this is typically caused by air movement. The false triggering of a PIR sensor can be fixed by making the sensor less sensitive. By increasing the Debounce time parameter (on the Global tab of the PIR sensor), we can ensure that more movement is required before the load is turned on.

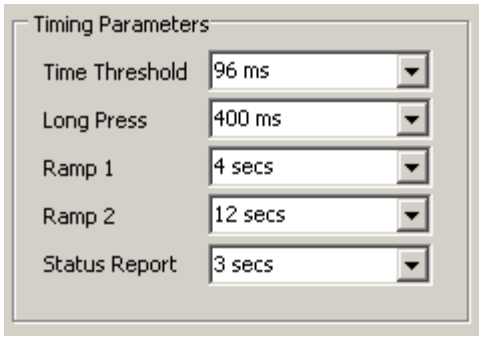


Figure 109 – The Time Threshold parameter

NOTE: The Time Threshold time on a PIR sensor is 96 ms to help reduce false triggering, where a standard C-Bus wall switch is 48 ms. (Time Threshold time is also known as Debounce time)

Light Level Sensors

The Light Level Sensor programming GUI is broken up into 3 programming areas:

- Groups
- Ambient Light
- Target.

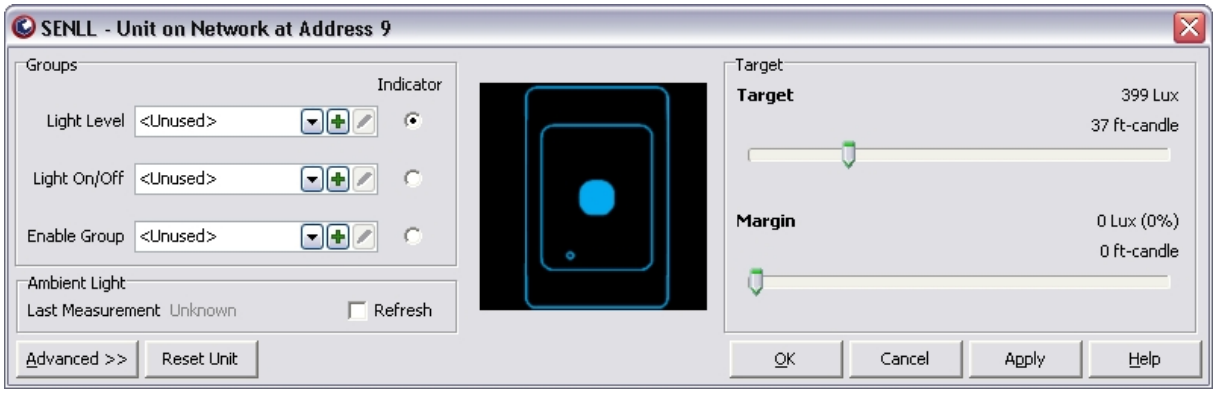


Figure 110 - The Light Level Sensor GUI

The Groups settings consists of 4 parameters:

- Light ON/OFF
- Light Level
- Enable Group
- Indicator.

The Light ON/OFF parameter will turn a group address ON and OFF once the ambient light level crosses the specified Lux target level. Once the ambient light level that is measured by the sensor is falls below the target Lux level, the load will turn on. Once the ambient light level that is measured by the sensor is rises above the target Lux level, the load will turn off.

The Light Level parameter will dim a group address Up and Down (over a 60 second ramp time), to ensure that the specified Lux target in the area is maintained. Once the ambient light level that is measured by the sensor falls below the target Lux level, the load will ramp up to increase the amount of light in the area. Once the ambient light level that is measured by the sensor is rises above the target Lux level, the load will ramp down to reduce the amount of light in the area. Basically the Light Level Sensor is trying to maintain a constant Lux level in the area.

NOTE: When using the Light Level parameter, the sensor will always turn on the load when the ambient light level falls below the target Lux level. The Light Level parameter will never turn the load OFF, as the sensor will ramp the load down to 1%. If you wish to turn off the load you will need to disable the Light Level Sensor, and then issue an OFF command to the load.

When using the Light Level parameter, it is best to disable the sensor from operating at night to ensure the light does not turn ON automatically due to low Lux levels. A group address which is programmed into the Enable Group parameter, will behave as follows:

- when the Enable group is ON, the light level sensor will operate
- when the Enable group is OFF, the light level sensor will not operate.

NOTE: If there is no Enable group, the light level sensor will always be enabled by default.

The Indicator parameter allows you to specify which group address the indicator will show the status of.

The Ambient Light section of the programming GUI will display the reflected light level that is being read at the light level sensor (not at the floor). This is used as a guide to determine the target Lux level. To view the reflected light level you must ensure that:

- Toolkit is physically connected to the C-Bus network
- The Refresh check box is selected, which will update the Last Measurement parameter every five seconds.

The Target parameters consist of 2 settings as shown below.

Parameter	Description
Target	The Target parameter allows you to specify the level that the Light ON/OFF and Light Level parameters will operate at. Remember that this target is measured at the unit, not at the floor.
Margin	The Margin parameter allows you to specify the amount of light variation that will occur before the Light Level Sensor will control the load. This is used to ensure that scenarios such as passing clouds do not have sudden affect on the loads.

Table 46 - Setting the target level on a light level sensor

The image below shows the relationship between the ambient light level, the Target and the Margin.

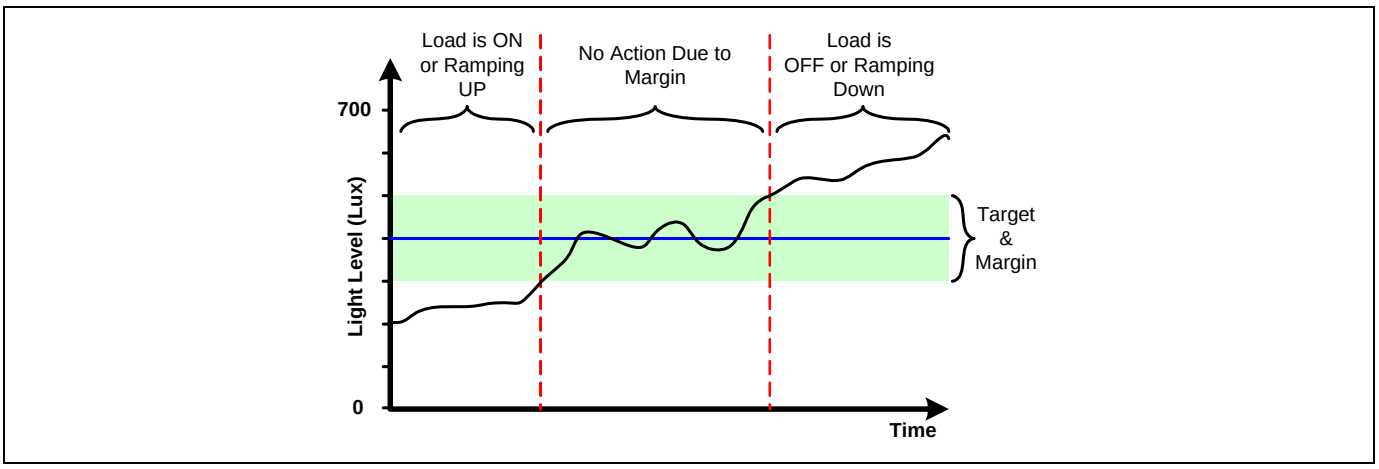


Figure 111 - Load control depending on light level

Scenes

The implementation of scenes has many benefits. At the press of one input button, you will be able to control a defined set of C-Bus output units such as dimmers, relays, etc. This means that you can control a range of loads such as lights and fans using a single scene.

C-Bus wall switches that are capable of using scenes, allow:

- 8 scenes to be used on the unit
- up to 40 group addresses to be used across all of the scenes
- a single ramp rate for each scene.

To begin programming a scene, double click on the Neo (or any other scene enabled unit) in the Database or Network section of the Programming window. This will open the GUI of the unit.

Decide which button of the C-Bus unit you wish to program a scene into, and select the <Scene> key function for that button. You will then see 'Scene 1' as the scene name for that button, as shown below.

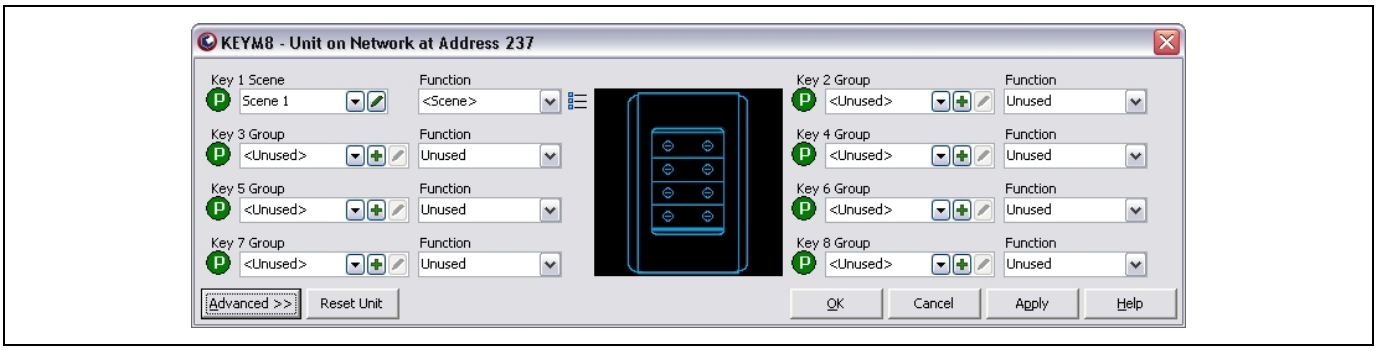


Figure 112 - Allocating a scene to a button

Clicking on the Function Details button to create and edit the scene, will open the form shown below. This form will allow you to configure which scene the selected button will control, and a Ramp Rate for all the group addresses inside the scene.

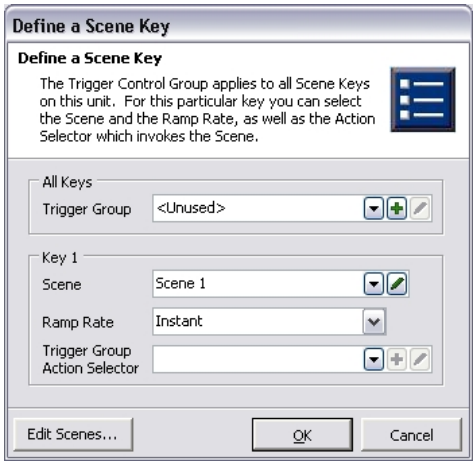


Figure 113 - Selecting the key/button and ramp rates

Once you have specified the ramp rate and which key/button will control the scene, click on the Edit Scenes button to view the Scene Manager as shown below.

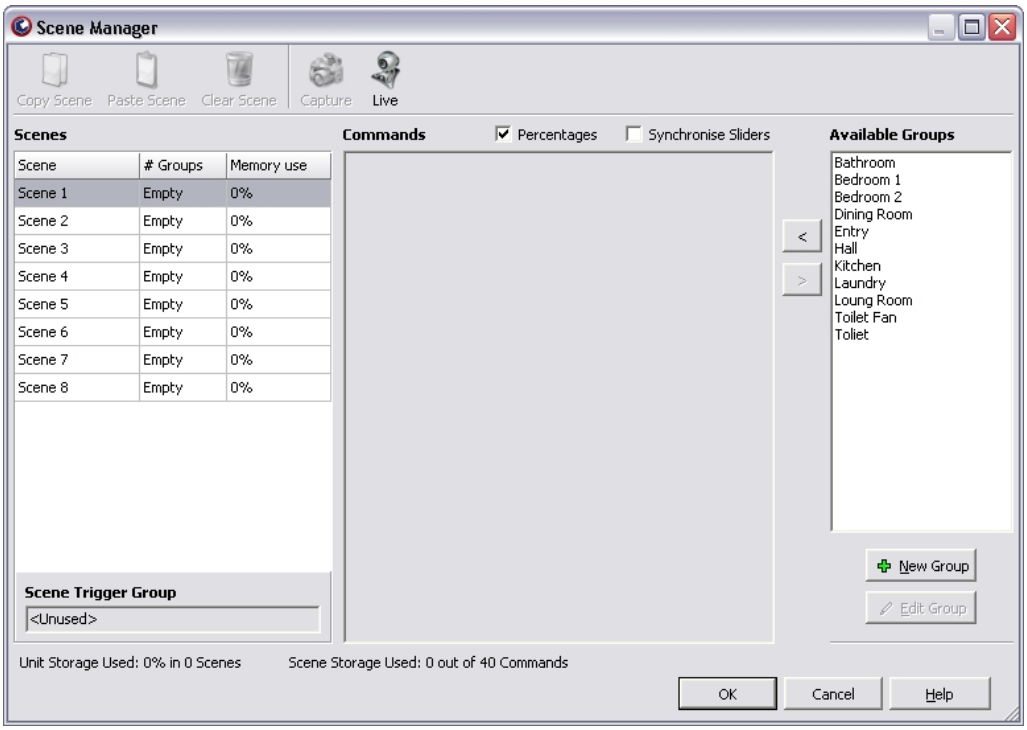


Figure 114 - The Scene Manager

You will find that the Scene Manager is divided into 4 sections.

Section	Description
Scenes	The Scenes section shows the 8 available scenes that may be used. It will also show how many group addresses are used in each scene, as well as the amount of memory the scene is using (in the unit).
Commands	This displays the group addresses that actually make up the scene. It will also allow you to specify the set level of each group address.
Available Groups	This displays a list of group addresses that may be used to create a scene.
Scene Trigger Group	This displays the Trigger group address for the unit. Trigger groups are used to trigger the scene from a remote location.

Table 47 - Sections of the Scene Manager

To create a scene:

1) Select the relevant scene number in the Scenes section of the Scene Manager.
2) Navigate to the Available Groups and double click on the group address you want to add to the scene.
3) Adjust the slider to set the level that you want the group address to go to once the scene is set.
4) Repeat this process for all of the group addresses you need in the scene.
5) Click the OK button, and then save and exit.

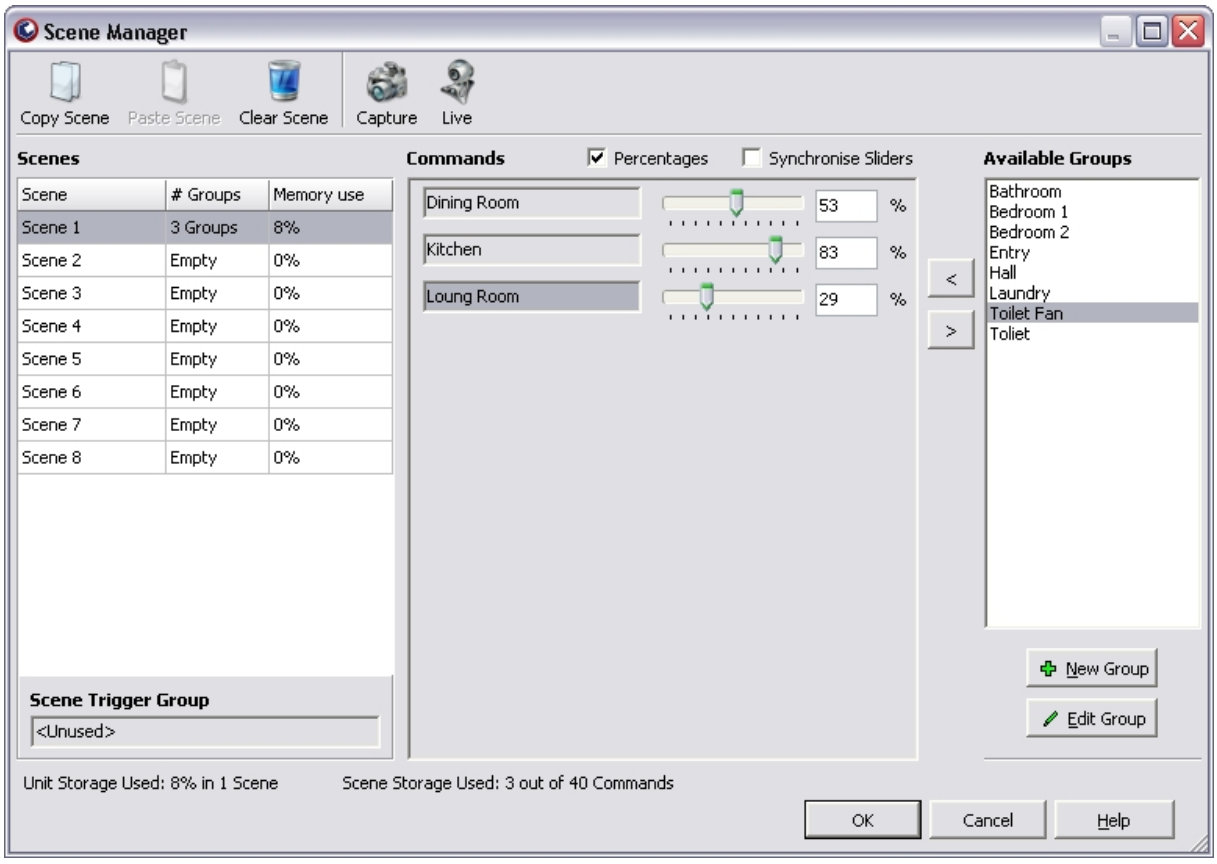


Figure 115 - A completed scene

Now when you press Button 1 of the Neo, the scene will be set.

NOTE: You can't turn off the scene from the same button. Scenes may only be set, and they cannot be toggled ON and OFF. If you want to turn the scene off, a second scene with the same group addresses (all of which are set to Level 0%), must be created and stored in a different button.

Remote Triggering Scenes

Remote triggering scenes is the process of having a scene triggered from a different location (as opposed to the unit that it is stored in). So you may have an ALL ON scene and an ALL OFF scene stored in a Neo, but both of these scenes can be set from a remote location. This is achieved by using trigger groups and action selectors.

The image below shows that two scenes are set depending on the level of a group address:

- If the Trigger group address = Level 255 (ON), then set Scene 1.
- If the Trigger group address = Level 0 (OFF), then set Scene 2.

We typically use the 0 (OFF) and 255 (ON) to remote trigger scenes, because these are the levels that an On/Off key function will toggle between. So effectively it appears that we can toggle between two scenes, when in fact we are using a single group address to set two scenes.

This trigger group address may be programmed into any C-Bus unit on the network (e.g. 1 button wall switch, PIR sensor etc.), which means as long as the trigger group address is set to 255 (ON) or 0 (OFF), then the scenes will trigger.

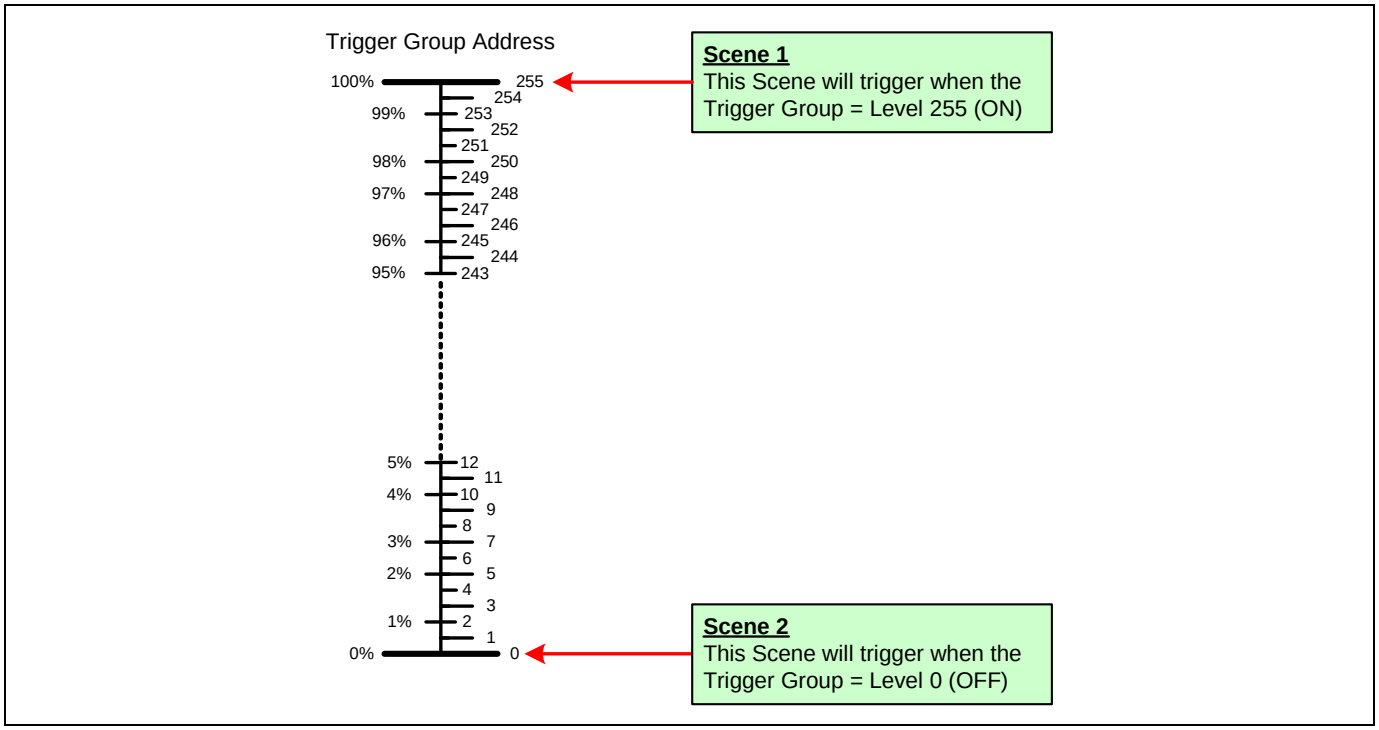


Figure 116 - Remote triggering scenes

NOTE: Technically you may have up to 255 scenes trigger from a single group address.

To begin remote triggering a scene, program the scenes as normal and ensure that they work as expected. Once you have verified their operation, follow the steps below.

1) Click on the Function Details button associated to the scene, to view the form below.

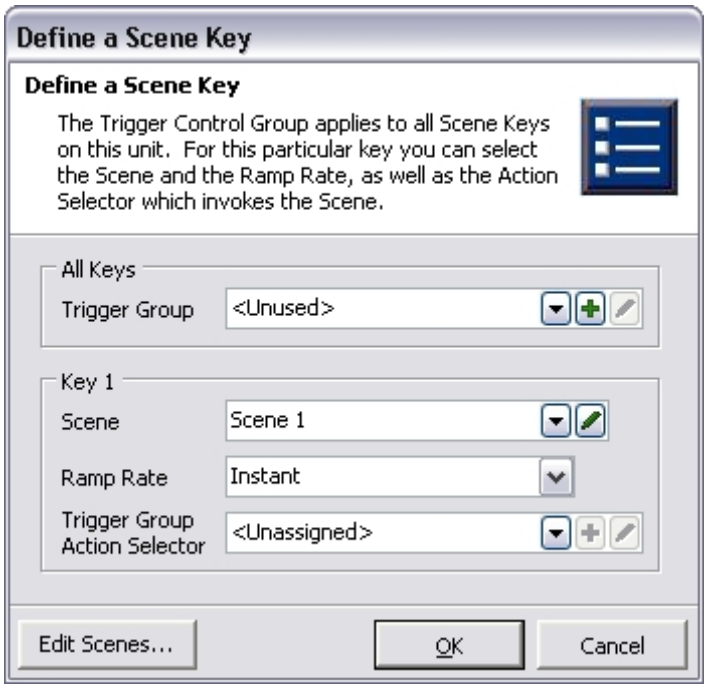


Figure 117 - Function details form for a scene

2) In the All Keys section, create a new group address for the trigger group. Use a tag name like “Remote Trigger” as shown below.

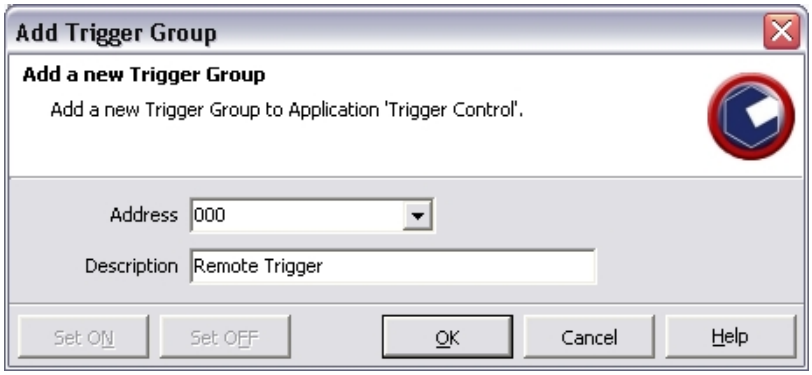


Figure 118 - Creating the trigger group address

3) Navigate the ‘Trigger Group Action Selector’ button ( ) and create a new level.

NOTE: This Trigger Group is on the Trigger Control Application, not the Lighting Application.

4) Select the relevant Address for the Action Selector and give it a description.

NOTE: The action selector is the level of the trigger group that will trigger the scene. You may name the action selector just like a group address so that you know exactly what it controls e.g. On Scene, Party Scene, After Hours Scene etc.

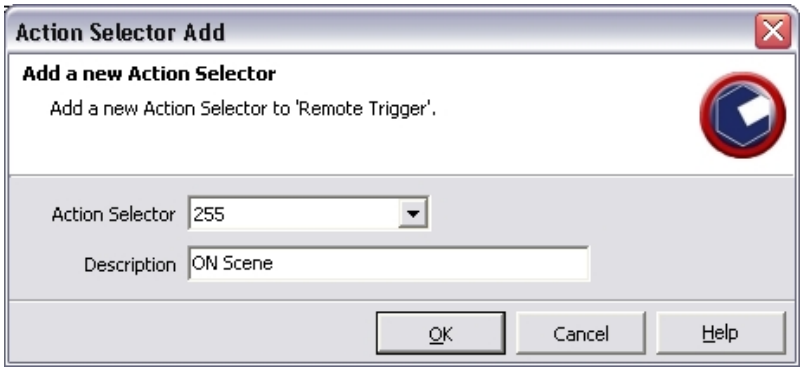


Figure 119 - Creating the action selector

5) Press the OK button and continue on to save and exit the GUI.

Now when the remote trigger group address equals “ON Scene” (Level 255 / 100%), Scene 1 will be set.

All that is left to do is program the remote trigger group address into another C-Bus input unit, and set its key function to On/Off.

DLTs

DLT stands for dynamic labelling technology. The basic principles of programming a DLT are identical to those of a Neo or Saturn switch. The main difference between programming a Neo and a DLT is the labels.

To begin programming a DLT, double click on the unit in the Database or Network section of the Programming window. This will open the GUI of the DLT.

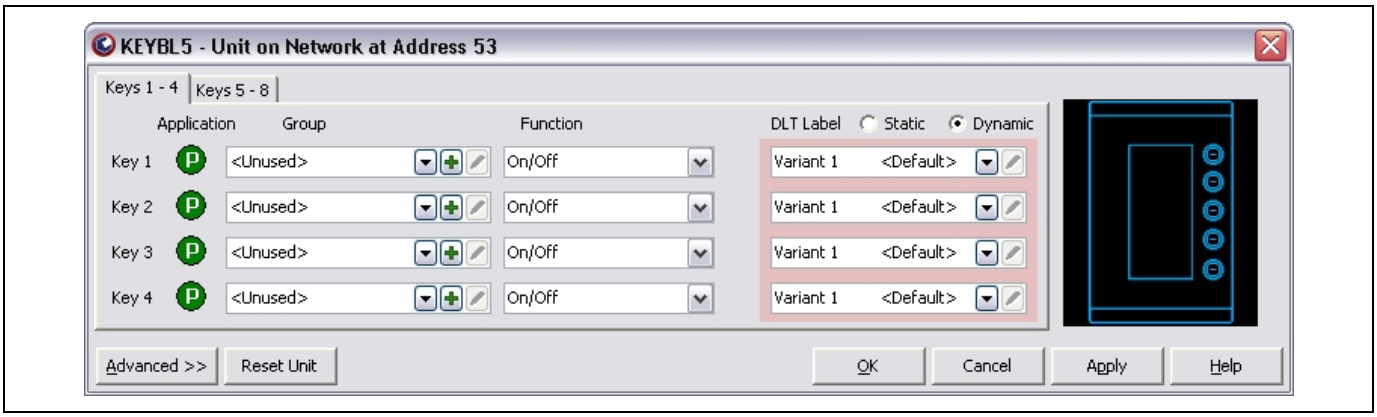


Figure 120 - Simple programming view of the DLT GUI

You will notice at a first glance, that the DLT only displays 4 buttons. On a closer inspection, you will see that there are two tabs which resemble the 2 pages of the DLT:

- Tab 1 allows the programming of Buttons 1 to 4.
- Tab 2 allows the programming of Buttons 5 to 8.

The group addresses and key functions are programmed as normal. However there are two different types of labels:

- dynamic
- static.

Dynamic labels allow the labels to be changed (at any time), by C-Bus Toolkit, a touch screen or Multi Room Audio system.

Once a static label is programmed and saved into a DLT, you lock out the ability to save new labels to the DLT. This can be done by changing the existing label from dynamic to static. Once you save changes, the DLT will not respond to software and hardware that tries to change its labels.

NOTE: Typically you will not need to use static labels, as almost all C-Bus installations use dynamic labelling.

Once you have programmed a group address into a key/button you will see that the group address tag is automatically written to the label for the associated key/button.

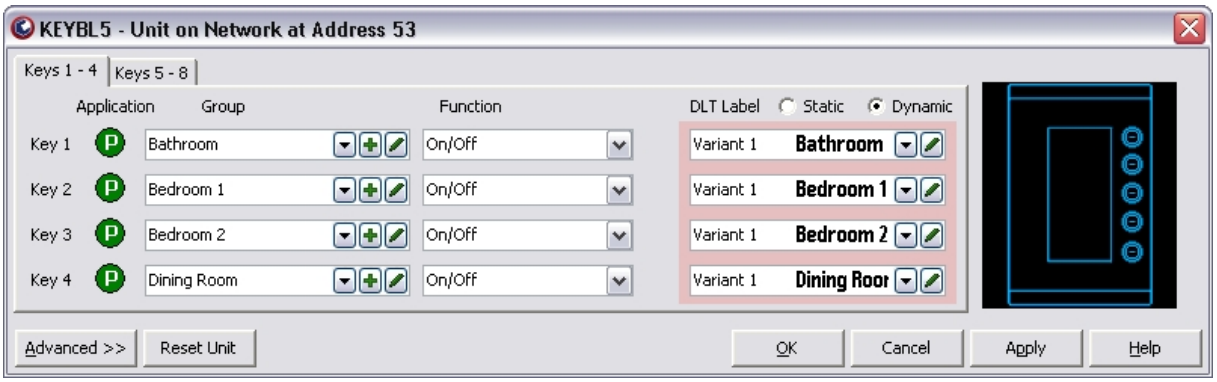


Figure 121 - Group address tags being used as labels

If you would like to change the Label so it is different to the tag, you may press the Edit button ( ) to change label. This will open the form shown below.

In the Label field, type the new label. In the preview display, you will physically see how the label will appear, and if it is too long for the LCD display. You may need to be creative to find suitable labels.

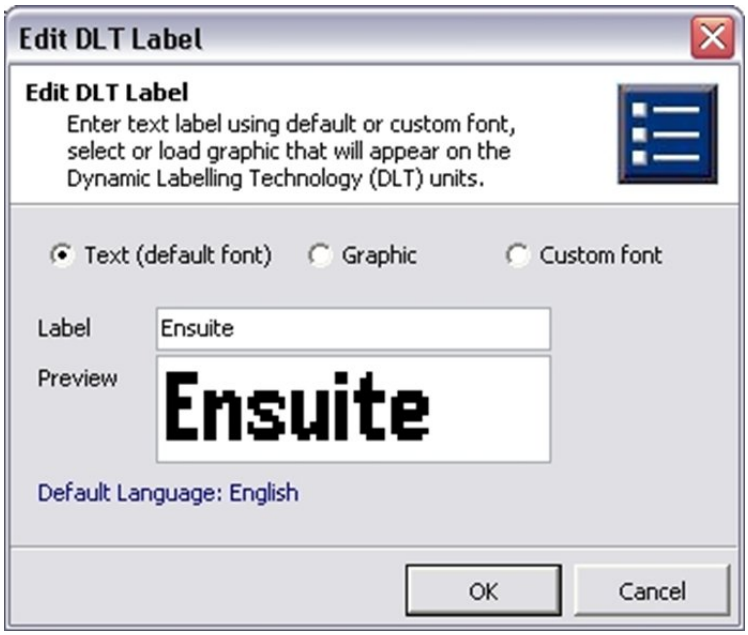


Figure 122 - Changing a DLT label

Variants

A Variant is a feature of a DLT that allows us to use different Labels for the same group address. Each button/key on a DLT allows us to use 4 variants (of a DLT label) for each group address that is used.

Imagine you had a DLT, which was using the 3 button configuration to control a C-Bus Shutter Relay. All three buttons use the same group address, but have different key functions (Shutter Open, Shutter Close and Shutter Stop).

Since a single group address is used across 3 buttons, it does not make logical sense for all buttons to have the same label. What makes more sense is to label each button with different label to explain its operation.

The image below shows three buttons on a DLT with the Bedroom 1 group address, and the 3 button function for control of the C-Bus Shutter Relay. You will see that:

- Button 1 uses Variant 1 that is labelled as Open
- Button 2 uses Variant 2 that is labelled as Close
- Button 3 uses Variant 3 that is labelled as Stop.

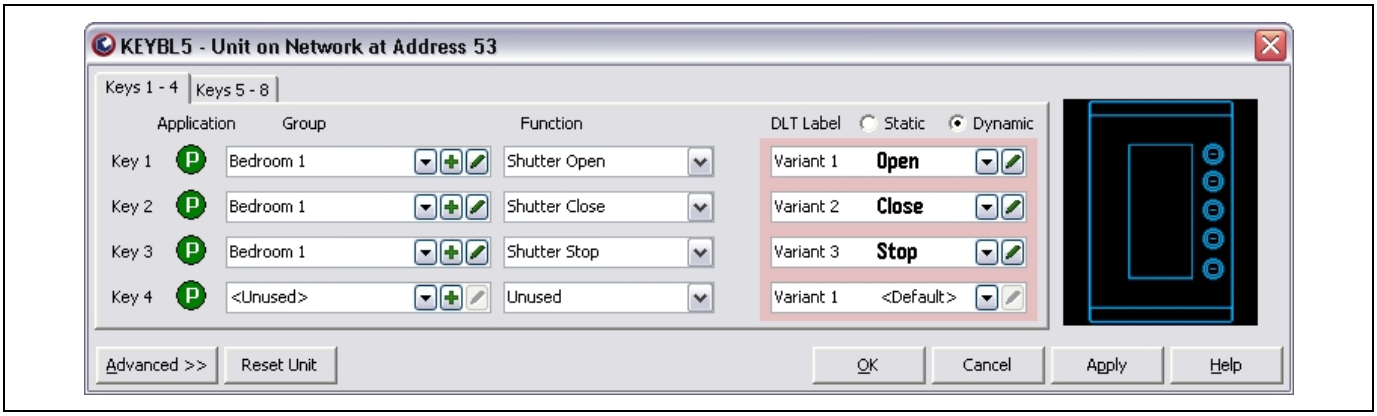


Figure 123 - A DLT using variants

To program a variant, select the variant number (1 to 4) you wish to use, and press the Edit button ( ) to change label for that variant. You will notice that as you create more label variants for a group address, they will show up in the Variant drop down box as shown below.

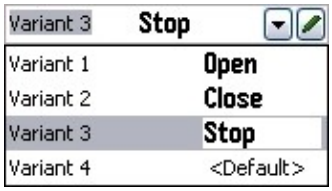


Figure 124 - The variant labels of a group address

Labelling Scenes

To label a scene on a DLT, some additional programming is required. You will need to program each scene as though you want it to be remotely triggered. So by clicking on the Function Details button for the appropriate scene, you will need to:

- create a trigger group address to the DLT e.g. a group address tag called “Scene Labels”
- create a trigger group action selector for the relevant scene. This will be the label of the scene, e.g. All ON, Party, Reading etc.

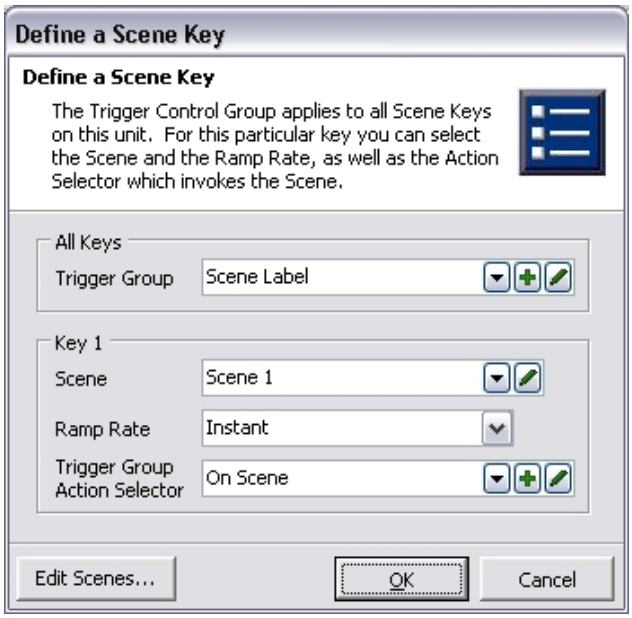


Figure 125 - Creating a trigger group action selector to label a scene

Now when you go back to the simple programming view of the DLT you will see the “On Scene” label appear in the Variant 1 parameter as shown below.

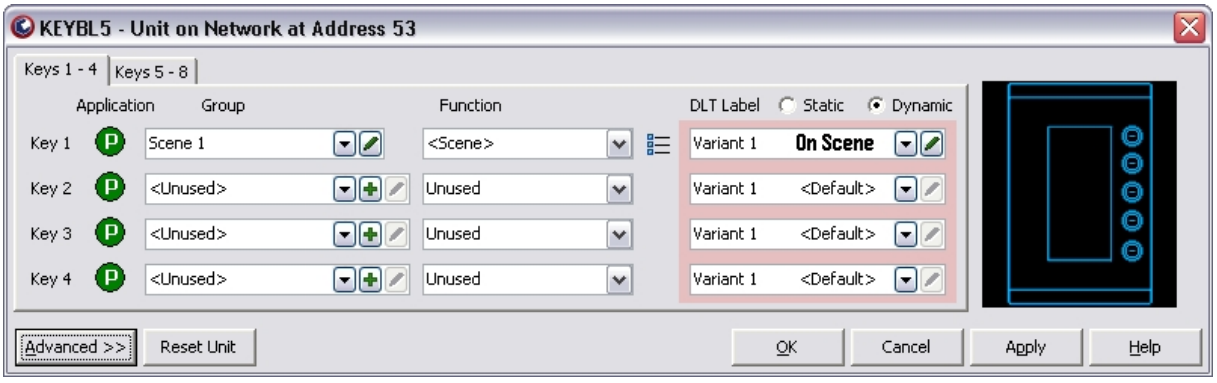


Figure 126 - Scene 1 labelled as "On Scene"

C-Bus Diagnostics

Basic Diagnostic Process

When any unexpected behavior occurs on C-Bus, a structured diagnostic approach must be taken to resolve any issues. The flow chart below details a basic diagnostic process, which should be followed when experiencing any fundamental hardware or programming issues with a C-Bus network.

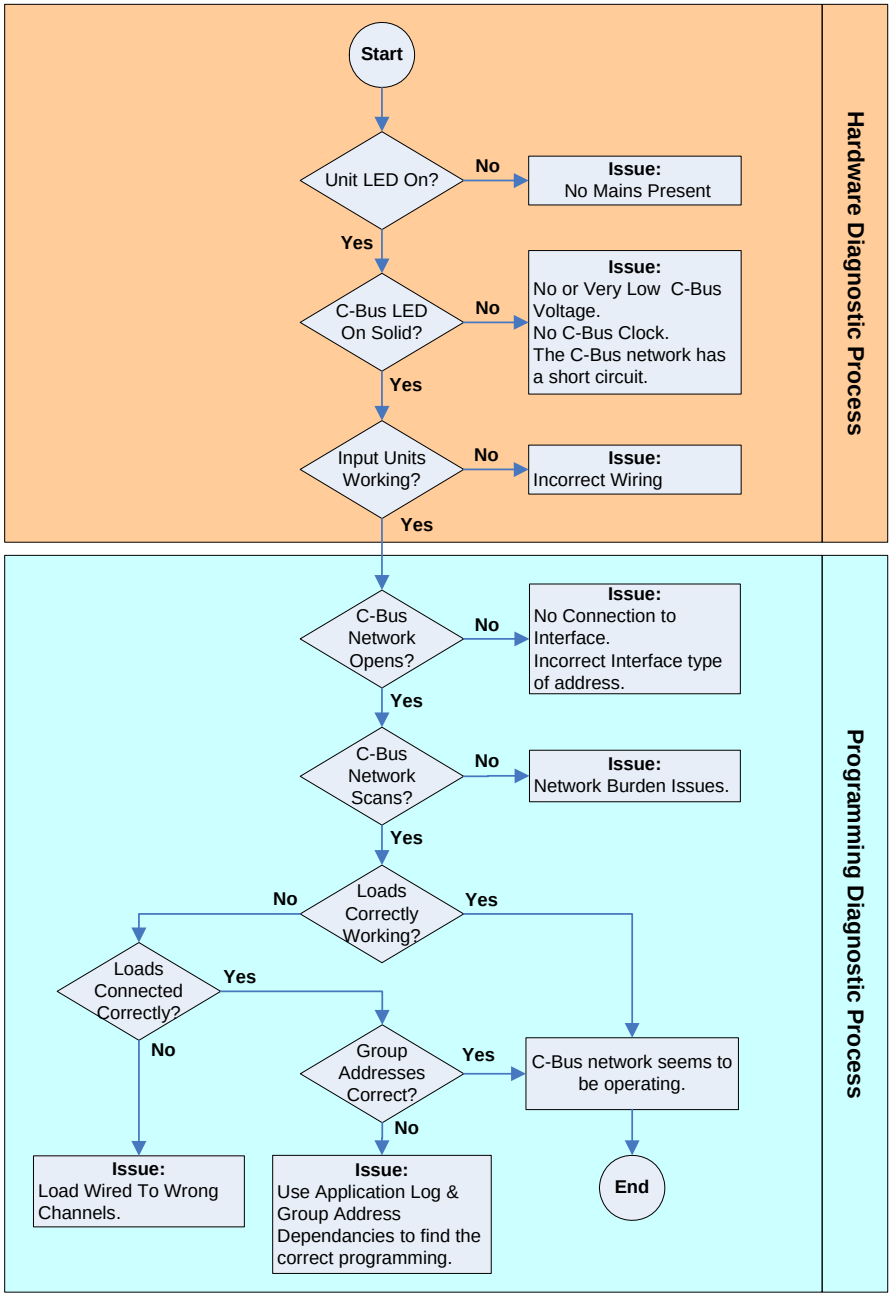


Figure 127 - The basic steps for low level C-Bus diagnostics

Analysis Tools

There are a number of tools and software packages that may be used to analyse a C-Bus network. These include:

- the C-Bus Network Analyser
- a multimeter
- an oscilloscope
- the C-Bus Diagnostic Utility.

These tools are used to assess the correct operation of a C-Bus network, the end result being an ideal installation for the customer.

C-Bus Network Analyser

The C-Bus Network Analyser (5100NA) is a hardware tool that is used to analyse the conditions on an existing network. To use it, simply connect the red terminal to C-Bus positive and the black terminal to C-Bus negative. After approximately 5 seconds, all of the units LEDs will turn ON and OFF. This indicates that the Network Analyser is functioning correctly.

Figure 128 - The C-Bus Network Analyser

Each LED on the C-Bus Network Analyser indicates a certain condition. These conditions are listed below.

LED	Status Of LED	Check / Action
Power Available	OFF / Flash	Check that C-Bus Power is available. If LED flashes, add a C-Bus Power Supply.
Clock Not Present	ON	Enable a C-Bus Clock on a DIN Rail Unit via Learn Mode.
Excess Voltage	ON	Remove a C-Bus Power Supply
Remove Burden	ON	Remove a Network Burden.
Add Burden	ON	Add a Network Burden.
Excess Cable	ON	Reduce the length of the C-Bus cable or split the C-Bus network with a Network Bridge.

Table 48 - C-Bus Network Analyser LED indicator functions

The push button on the C-Bus Network Analyser temporarily adds a network burden to the C-Bus network. The network burden will be removed as soon as the push button is released.

This function is used to test to see if the network impedance is within its tolerance. If the Add and Remove Network Burden LEDs are flashing alternately then this indicates that the network is within a stable tolerance.

NOTE: When the C-Bus Network Analyser is connected to a C-Bus network, it disturbs all C-Bus communications on the bus and causes temporary instability. The installation may not function as expected during this period.

Multimeter

A multimeter is one of the most versatile and easily accessible measurement instruments. It possesses a number of functions that can test a C-Bus network for unexpected behaviours:

- Ohm meter
- DC voltage meter
- AC voltage meter
- audible continuity test.

When using a multimeter remember to test the C-Bus network at various points by using successive approximation. This will help identify any unexpected conditions along the C-Bus network.

Oscilloscope

An Oscilloscope is another vital tool used in C-Bus network analysis. It is more complicated to use than a multimeter but it allows the user to perform advanced readings and measurements that would be unable to achieve using other measurement instruments. An Oscilloscope will be able to view the:

- C-Bus clock
- AC voltage waveform
- DC voltage waveform
- waveform frequency and period
- effect of a network burden
- any other unexpected behaviour of the C-Bus clock.

With a mains rated probe or a current probe an oscilloscope can also be used to check mains voltage and current on the mains part of a C-Bus network. Care must be taken when taking mains voltage measurements with an oscilloscope due to live exposed mains cables. Only a fully qualified electrician should take these measurements.

Diagnostic Utility

The C-Bus Diagnostic Utility is a software package that analyses a C-Bus network, sends or receives C-Bus commands and logs information.

The C-Bus Diagnostic Utility generates a list that shows the transmitted data and received data. Transmitted data are the messages sent by the utility to C-Bus, and the received data are the messages that are generated by a unit on the C-Bus network.

The C-Bus Diagnostic Utility is available for free download from the Clipsal Integrated Systems website.

Figure 129 - The C-Bus Diagnostic Utility

Diagnostic Utility Setup

To set up the software for use please follow the steps below:

1) Navigate to the main menu and click the Options menu.
2) Select Program Options.
3) Select the appropriate C-Bus interface parameter and click the OK button.
4) Click the C-Bus menu.
5) Select Connect to C-Bus.

Once the software has successfully connected to a PC Interface a form as shown below will appear.

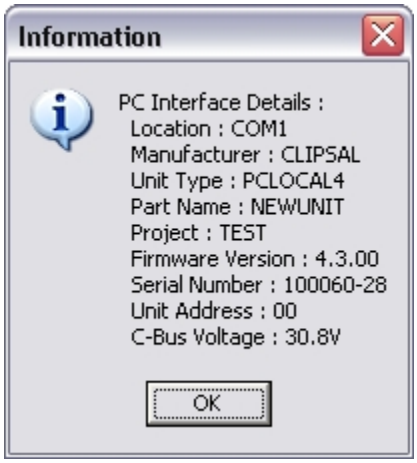


Figure 130 - The Information form indicates a successful connection to C-Bus

Using the C-Bus Diagnostic Utility

The C-Bus Diagnostic Utility can be used to:

- set the C-Bus interface into various modes
- identify any C-Bus unit on the network
- obtain the PC Interface data
- monitor C-Bus commands via the Traffic Analyser
- log the C-Bus messages to a text file
- control C-Bus with the Command Generator.

For further details on how to use the C-Bus Diagnostic Utility, please consult the help files with the utility.

Support and Training

Contact the Customer Information Center for technical support by phone at 1-888-778-2733 or e-mail at lightingcontrol.support@us.schneider-electric.com.

You may also find helpful information on our web site at www.Schneider-Electric.us.

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